ELECTRICAL WORLD

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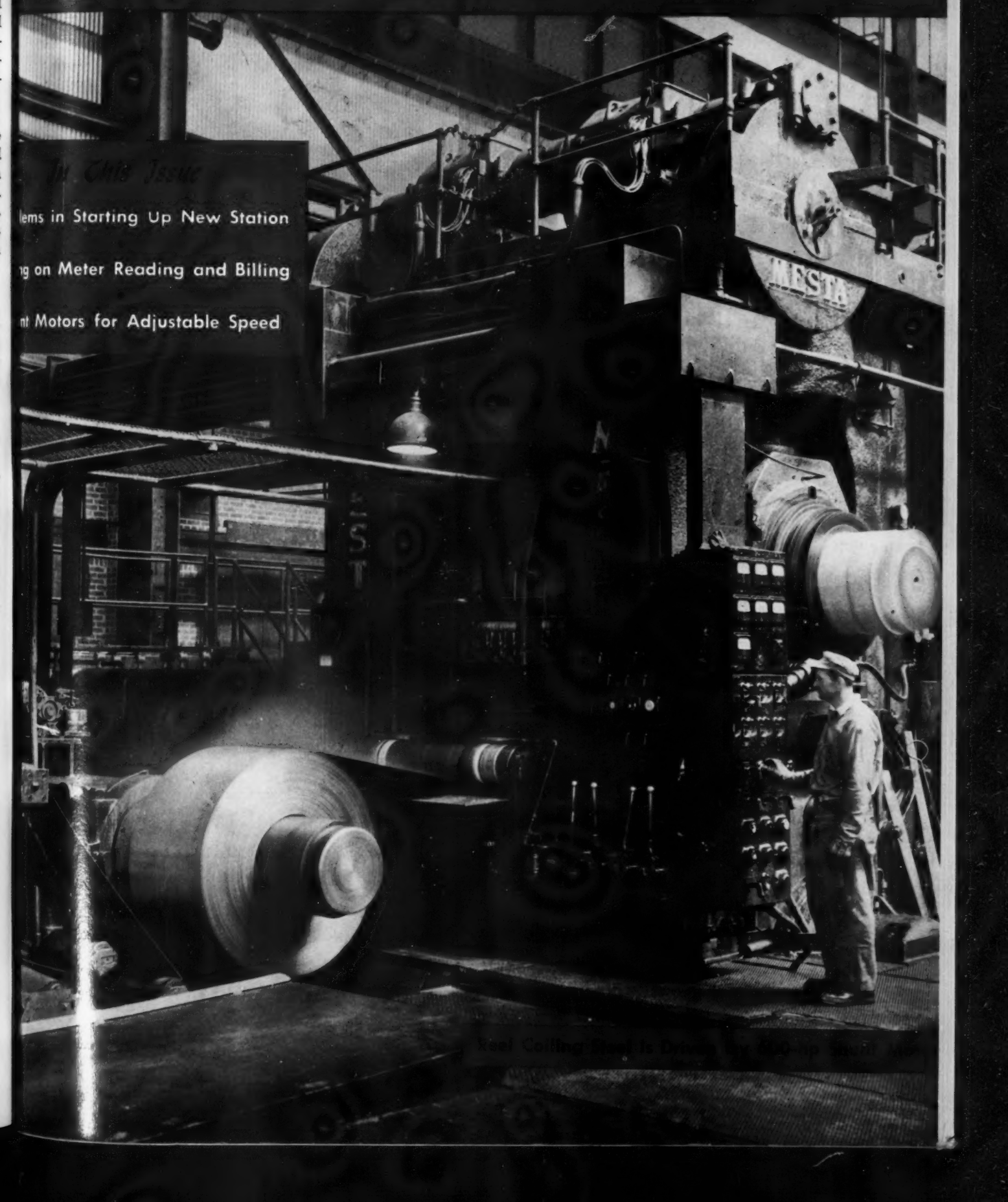

In This Issue

lems in Starting Up New Station

ıg on Meter Reading and Billing

ıt Motors for Adjustable Speed

LINE-CLEARIN TREE-TRIMMIN

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Murray crow's nest

Sleet, snow, ice, torrential rains —these are the destructive forces which put utilities on their mettle and repair crews on their toes. This winter has proved—as have so many, many winters—that Murray Crows'nests make the job of clearing debris by tree-trimming and re-stringing easier, faster, less costly. They are all-year maintenance ladders. Send for full data on the fastest, easiest operating maintenance ladder made. Many models available.

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ELECTRICAL WORLD

Published for 74 years for those engaged in the business of generating, transmitting, distributing or applying electric power

November 20, 1948 — Vol. 130 No. 21

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Delivery end of 56-in. 4-stand cold sheet mill. The tension reel is driven by a Westinghouse 600-hp double-armature, adjustable speed, shunt-wound, d-c motor. Maximum delivery speed of mill is 3,000 fpm. Master control for mill and reel is in cabinets mounted on mill housing at operator's right. For article on applying adjustable speed shunt motors, see page 92

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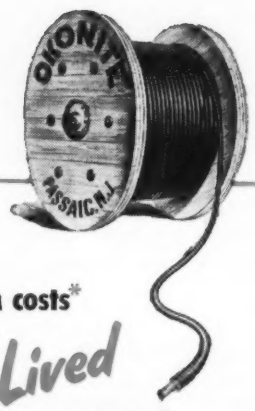
COMING IN THE DECEMBER 4 ISSUE

Application of Switched Capacitors
Large Capacity Service Bus Design
Loading Effect of Transformer Type Welders

ONLY COMPLETELY-PROTECTED CONDUCTORS ASSURE *Longest-Lived* WIRES AND CABLES

. . . and only Okolite-Okoprene cables possess these 9 "factors of protection"



With today's installation costs* only the *Longest-Lived* will be economical

* The lifetime cost of a cable rather than its first cost is the only true measure. Okonite wires and cables, built to stand up better and longer, can offset high installation costs.

1. Conductors are coated with corrosion-resistant Okoloy, a lead alloy that outlasts tinning 2 to 1.
2. Internal corona cutting is eliminated and dielectric strength increased by Semicon Tape applied over the conductor on all Okolite-Okoprene cables operating at over 2000 volts.
3. Moisture-resisting, high-voltage Okolite, an oil-base insulation proved in over 20 years of service, is made with Up-River Fine Para, the best grade of natural rubber. Approved as Type RWSN by Underwriters' Laboratories.
4. The Okoprene covering, a pioneering development of the Okonite laboratories, has established its stability and permanence on millions of feet of cable installed since 1935 under the most severe conditions.
5. Both insulation and jacket are applied together in a single operation by the strip-process and uniformly vulcanized in a continuous metal mold to give the best and most dependable bond.
6. Insulation and covering receive but a single vulcanizing "cure" thus eliminating the life-shortening effects of double vulcanization.
7. Thickness of both insulation and jacket are accurately controlled by the Okonite strip-insulating process.
8. In addition to a. c. tests, every Okolite-Okoprene cable is subjected to high-voltage d. c. tests more severe than used by any other cable manufacturer.
9. Okolite-Okoprene cables have the longest and most extensive service record.

Okolite-Okoprene's electrical operating advantages, installation advantages and design advantages are given along with dimensional data in illustrated, information-crammed Bulletin EW-1037. For a copy, please address The Okonite Company, Passaic, New Jersey.

6627

OKONITE OKONITE SINCE 1878 **insulated wires and cables**

THE BEST CABLE IS YOUR BEST POLICY

Forward – At Full Speed

Some in this industry now wish to curtail the legislative and public information activities of the operating electric utility industry. They suggest that the industry halt its attack on legislation which weakens it. They desire to shun the unification which has been recognized as vital. They even suggest changing the advertising program. All this would be based upon the results of the recent election.

During the two years of a Republican Congress, did labor groups stop fighting restrictive legislation? Did farmers give up on the support of the tax on oleomargerine? Did the real estate groups give up on the housing legislation? They certainly didn't. Anyone who suggests that the industry do anything other than expand its activities is ignoring the facts of life.

This industry has a good case to present to the people—and not only from the narrow viewpoint of self preservation. It has such a case also from the broad position of maintaining free enterprise.

Socialism in this country came one step nearer last Nov. 2. It came either because the voters wanted it or because the voting public is not informed. The ultimate results will be the same.

Before we criticize those who voted to come a step closer to the socialistic state, either consciously or unconsciously, let us determine who they are. Look around you and guess how many of those in your own organization voted for more public power, along with their families and friends. Count the votes among your customers, who represent a portion of the forty million receiving electric service in the United States. Count them among your business contacts with local, state and federal authorities, wholesalers, retailers, clubs and stockholders.

The utilities are in daily contact with the voting public to a greater degree than any other group except perhaps the radio, press or corner grocery. If these people inadvertently voted for more socialization of the power industry, it was because they either were unaware of the consequences or felt this to be a minor point. In either event, industry management is not excused from the responsibility of doing a better job in the future.

This better job obviously includes more than improved service. It requires a better understanding among employees, customers, friends and, most of all, the voters of tomorrow, of the good job electric companies have done. And finally, it means the recognition of the importance of a departmentalized public information activity, with adequate personnel and management backing.

The signal is clear. It cannot be less, it must be more. For failure to go forward at full speed would be admission of doubt. That kind of doubt has plagued the Republican party in its fence-straddling operation for 20 years.

Let it be clear where this industry stands, the case which it has, and why it is the only safe way for America.

Hydrostatic Tests For Generators?

THE INCENTIVE is strong today to increase the gas pressure of large hydrogen-cooled turbo-generators above 15 psi to secure for peaking purposes the attractive increases in output that lie in that zone.

But there are obstacles to this. Some of them appear ridiculous; particularly the code situation prevailing in many states that requires hydrostatic testing of generator housings operating at hydrogen pressures above 15 psi.

Most state codes and insurance regulations follow the ASME code definition, under which a vessel having a gas volume greater than 7.5 cu ft, and an operating pressure greater than 15 psi falls in the class of an "Unfired Pressure Vessel", IF interpreted to be used in that sense.

Whether the housing of a rotating machine properly falls in the unfired pressure vessel class has never been conclusively settled. Pennsylvania and a couple of other states and some insurance company representatives have ruled that a generator housing is a machine part and is not governed by the unfired pressure vessel code.

But in states where no clarification of the definition has been sought from code authorities, both manufacturers and purchasers of hydrogen-cooled generators operating above 15 psi are responsible for seeing that their machines meet the unfired pressure vessel code.

As C. M. Laffoon pointed out in his article *Today's Trend in Turbo-Generator Design*, (ELECTRICAL WORLD, Nov. 6, 1948, page 85), this can mean hydrostatic testing of the final structure during manufacture, stamping the material specification number on component parts and provision of a name plate that gives the hydrostatic test pressure and the hydrogen operating pressure. In some states, Mr. Laffoon points out, subsequent annual inspection is required and additional hydrostatic tests may be demanded by the inspector!

Eventually all state code authorities and insurance groups will follow Pennsylvania's lead in declaring generator housings to be what they obviously are—parts of machines. But this will take years at the present rate.

Meanwhile, manufacturers and users who really want that 10% increase in capacity that is available at 30 psi (above the 15-psi output rating) must go through the expensive and rather ridiculous motions of hydrostatic test and annual inspection—or go without some cheap kilowatts that may come in mighty handy one day.

Haste Can Waste Kilowatts

EVERY KILOWATT to become available between now and Christmas week will be a welcome addition. But it is important that the preparations for additions be set up with as much regard for security as for haste.

In the urge to get new kilowatts on the line there is great temptation to omit many of the precautions which have habitually been taken with new plants and new units. Past experience in more serene years may easily have indicated that testing and checking and rechecking was often little more than confirmation of good equipment well installed. Little in the present situation warrants such confidence in the integrity of the myriad of tasks involved in the installations in a power plant.

Astounding is a mild word to apply to some of the episodes reported in circles where power plant energization is being discussed. Unbelievable carelessness and lack of regard for the delicacy of electrical equipment and electrical instruments have been reported. Damage in transit is a common occurrence and some equipment is being hauled by motor freight to reduce the number of handlings and transfers. Equipment on the job has been left exposed to the weather after unpacking, largely neutralizing the care taken by the manufacturer to protect the insulation and the vulnerable components.

Any disposition to curtail the amount of testing and checking is likely therefore to result in subsequent mishaps and operating difficulties which will delay rather than expedite the sustained capability of new facilities.

Inadequate Adequate

THERE IS a newly published book, *Practical Residental Wiring*, which is as practical as its title says it is. Following its instructions, any person of average intelligence should be able to do a satisfactory job of ordinary house wiring in compliance with the National Safety Code. And then a lot of additional outlets would have to be put in if the occupant wanted to enjoy fully the comforts and amenities of modern electrical living. For continuance of the ordinary way ordinary houses are wired, the book is an excellent manual. But to the fullest enjoyment by ordinary folks of the modern values of electric service, the book makes little or no contribution.

Now, why is this? It is not that the author had never heard of the industry effort to promote adequate wiring or that he did not recognize the problem of inadequacy. Recognition of it is indicated in several places in the book. In one, the opening paragraphs of the chapter on surface extensions, the reasons for such extensions are discussed—more clocks, radios, electric blankets and other devices than outlets to plug them into. But all the instructions and examples on circuiting and layout are based on Code values. Thus the learner gets his first impressions of the art in terms of minimums, which is exactly what is wrong in the wiring picture. Architects specify and contractors quote minimums. Customers accept them, knowing no better.

The author of this book cannot be criticized for not playing up adequate wiring in it. He put into the book all that seemed to him necessary for a pliers-and-screwdriver workman to know about residential wiring. The fact that it did not seem to the author necessary to lay special emphasis on wiring adequacy is a criticism of the electrical industry in that it has not yet sold the adequate wiring idea to its members, much less to the public.

NEWS OF THE ELECTRICAL WORLD

The Electrical Week

Construction of all classifications will reach $18.5 billion this year, but the McGraw-Hill Department of Economics predicts next year will be even better, $19 billion plus . . . NEMA President W. C. Johnson warned members at their annual meeting at Atlantic City that sales of electrical equipment have reached their peak and that long-delayed postwar business development plans soon may have to be dusted off . . . In similar vein speakers at the General Sales Conference of the Southeastern Electric Exchange at Savannah predicted that the sales organization will be the most important and most pampered section of the industry in 1949 . . . Federal agencies concerned with developing the Pacific Northwest are nearing an agreement on their regional planning. They will present a united front in going after the 81st Congress for funds . . . Wisconsin will increase its generating capacity 88% in the next six years, the State Utility Association was informed . . . And for those interested in energy output, the percentage increase over last year is decreasing each week though the total output is still rising weekly to a record high.

Abraham Lincoln Hotel, Reading, Pa., is planning to install electric blankets in its better rooms.

Good news for the American taxpayer is the rapid recovery of Germany. Industrial production for October reached 75% of the 1936 level, the highest yet, and is still rising. Steel output is running at an annual rate of 7,500,000 ingot metric tons. Bizonia exports are triple those of last year. The one big problem is how to get more coal and electrical equipment.

Southwark Plant of the Philadelphia Electric Co has 3,000-kw of capacity per employee. This is more than three times the 950 kw of its older Schuylkill plant.

Mass quitting of work has been ruled "persuasive evidence" of a strike under the Taft-Hartley Act if there is no contrary explanation. The ruling was made by an NLRB trial examiner in a case involving members of an IBEW local who walked out of Oak Ridge when non-union employees of an electrical contractor started to install lighting fixtures.

Philip D. Reed, General Electric chairman, who is in England to attend sessions of the Anglo-American Productivity Council, has suggested that Britain might speed up her industrial production by sending "substantial numbers" of workmen and administrators to study modern U. S. factory methods.

Sales of conveyor belts are skyrocketing. Industries are installing them to cut production costs. Since the belts are motor-driven, more belts mean greater sales of electricity to industrial consumers.

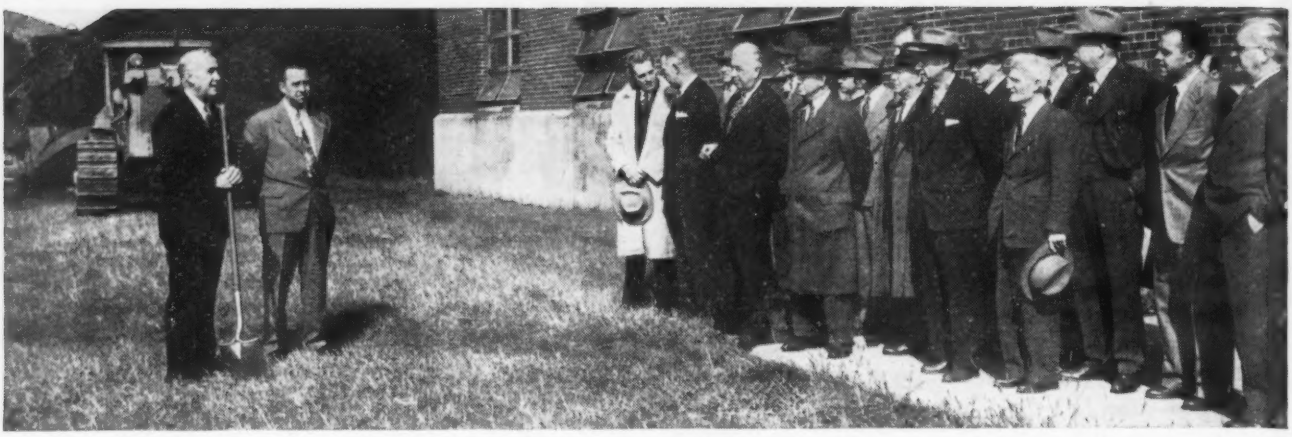
Since 1935 the price of electricity has come down. In that year only eight states had average monthly bills for 250 kwhr of residential service of less than $7.40. In 1948 only eleven states had bills over $7.40, and even in these 11 the bills were lower than in 1935.

Sweden is planning to increase its installed generating capacity from 1,340,000 kw to 2,705,000 kw by 1953. Practically all will be hydro since Sweden has no coal.

When Philadelphia Electric Co found it necessary to remove rocks from the channel below its Conowingo Plant on the Susquehanna, in order to improve runoff, it used aerial photos to determine which rocks were causing the trouble.

Notes From The News:

Union Electric Co of Missouri reports that it is in better shape to serve its customers than it was last year at this time. Credit goes to the 80,000 kw added last spring at its Venice Plant, greater efficiency at its other plants, and to the heavy rainfall . . . Daylight Saving Time is likely to be the rule along the Pacific Coast next summer. Voters in Portland and Seattle approved it on election day. DST is still in effect in California and parts of Nevada . . . Milwaukee Gas Light Co has taken a new approach to the problem of increasing rates. Before going before the PSC for an increase, the utility calls in attorneys for the affected cities and any opponents of the move. This



RALPH D. JENNISON, New York State Electric & Gas Corp president addresses guests at groundbreaking exercises for an addition to Jennison Station at Bainbridge. Station's 33,000-kw capacity is to be doubled. J. C. Dykman, plant superintendent, is at his left

eliminates many misunderstandings before hand and speeds the formal PSC hearing.

Tacoma's plan to build a hydro project on the Cowlitz River is getting strong opposition from fishing interests of northern region and southern Washington . . . Toledo Edison Co set a daily power production record on Nov 3 of 4,286,649 kwhr. October was also a record breaker, with 113,238,239 kwhr . . . Buffalo Niagara Electric would like to install smoke prevention equipment at its Huntley Station, but demand for electricity is so great that the plant can't be slowed down enough to permit the installation . . . Senator Wiley, Wisconsin Republican, has joined the opponents of the New York-Province of Ontario St. Lawrence hydro project because navigation is not included . . . North Carolina is getting 6% of the gross receipts of utilities. Now the municipalities want the state to give them a share.

Reclamation Commissioner Michael W. Straus has given the signal for postponing further cuts in Reclamation Bureau field personnel . . . The editor of a Nashville, Tenn., labor paper asserts a number of Tennessee organizations and business men have been receiving requests for pictures of TVA installations and detailed information about the Valley area. The unhappy part is that they are from Germans living in the Russian-controlled areas. Assumption is that the Russians want the information . . . Mississippi Power & Light Co has formed a Quarter Century Club. Forty-five employees qualified as charter members . . . Because the Post Office Department, which controls radio broadcasting in Britain, receives 40,000 complaints a year about radio interference, the House of Commons has passed a law allowing electrical inspectors to enter homes in search of appliances causing interference.

Although the past summer was drier than normal, rainfall artificially produced brought precipitation in excess of normal in four sections of Arizona . . . Electricity isn't just keeping the young people on the farm. It's keeping the retired farmer and his wife there also. Instead of moving to town, they now take a home near their former one.

FINANCIAL:

Virginia Electric & Power Co has reported gross revenues of $4,411,301 for October, an increase of 17.5% over the corresponding month of 1947 . . . Dayton Power & Light Co has been authorized by the Ohio PUC to issue $15,000,000 in 30-year bonds to be sold at competitive bidding . . . South Carolina Electric & Gas Co has filed a petition with the State PSC for authority to issue $3,000,000 in bonds to finance its construction program . . . Voters of Fulton, Mo., have approved a $300,000 bond issue to finance improvements and an addition to its municipal power plant.

Brockton (Mass.) Edison Co has borrowed $4,000,000 on 30-year first mortgage bonds at an interest cost of about 3% . . . Philadelphia Electric Co contemplates $19,000,000 in new financing early in 1949 in connection with a projected expenditure of $47,600,000 for new construction next year . . . Savannah Electric & Power Co has been authorized by the Georgia PSC to issue and sell $1,000,000 of 5% cumulative preferred stock to finance its construction program . . . Private placement of $4,000,000 in 3½% first mortgage bonds, due 1977, with a group of insurance companies has been announced by Portland General Electric Co

CONSTRUCTION:

New generating units are going on the line rapidly these days. Georgia Power Co has put a 22,500-kw unit in operation at Plant Mitchell; Ohio Power Co, a 125,000-kw unit at Brilliant Plant; New Brunswick Electric Power Commission, a 16,750-hp unit at Chatham, N. B.; and Shawinigan Water & Power Co, a 65,000-hp unit at Shawinigan Falls.

1948 Building Boom to Go Still Higher

Construction Bill Will Be $18.5 Billion in 1948 but $19 Billion Next Year—Only Serious Decline Expected in Industrial Classification

THIS IS a building year. Homes, office buildings, stores, factories, and farm structures are going up as fast as materials can be bought and workers hired. Everyone who hasn't already built seems ready to, indicating that 1949 will be another big year for the construction industry.

In dollars 1948 will smash all records for the industry. It is running more than 30% ahead of 1947. But because of price and cost increases, the industry's physical volume will be only 10 to 20% above last year's. Figured on the value of materials and the on-the-site cost of putting them together, new construction of roads, dams, buildings, houses, and other projects will add up to $18,500,000,000 for 1948. There will be another $8,000,000,000 plus for materials and manpower to maintain and repair existing structures. This means a total of $27,000,000,000 for 1948 construction.

Of this figure, the McGraw-Hill Department of Economics estimates, only a little more than $4,000,000,000 will go for public construction—highways, sewer and water systems, schools, hospitals and institutions, and conservation and development programs. Private enterprise is footing the remainder of the bill.

Despite all charges to the contrary, private enterprise is building housing. This year $8,000,000,000 will be spent for that purpose, adding about 1,000,000 houses to the nation's total. Next year the total spent may be a little less, but the year will still be a good one.

Bases of this optimistic view are the increasing number of families, the movement of population, and the dissatisfaction of many families with their present living quarters. This year 675,000 new families will be added. Several hundred thousand families will have moved from farms to towns. In certain states that have grown rapidly in population since 1940 there is still an extreme shortage of housing. And in every state there are thousands of families who have a roof over their heads but don't like it. They want modern homes with all conveniences. All this adds up to more housing for 1949.

One adverse factor in the coming year will be rent controls. Congress is certain to see that such controls are extended and may even make them more severe. Builders of rental units are unlikely to go ahead with such construction until they are certain what the future holds for them. On the other hand, Congress is expected to extend a helping hand to public housing. The two opposing forces may cancel each other.

Industrial building is sure to fall off in 1949. This year the total will be around $1,400,000,000. Next year it may drop as low as $800,000,000. More and more companies have all the buildings they need. With money tight, they are investing in new equipment, which will pay for itself in a few years through increased output, rather than in plants, which take about 20 years to pay off.

Public utility construction is the one type of industrial building in which there will be no letdown. Electric utilities will spend every cent they can get together. The total will depend on the ability of manufacturers to supply materials and equipment. Demand is so great that even if some utilities should change their plans and reduce expenditures, others would grab the materials and equipment released. Gas, communication, and transportation utilities are in a similar position.

Commercial Building Up

Commercial construction, which will run $1,400,000,000 in 1948, will equal or better that figure next year.

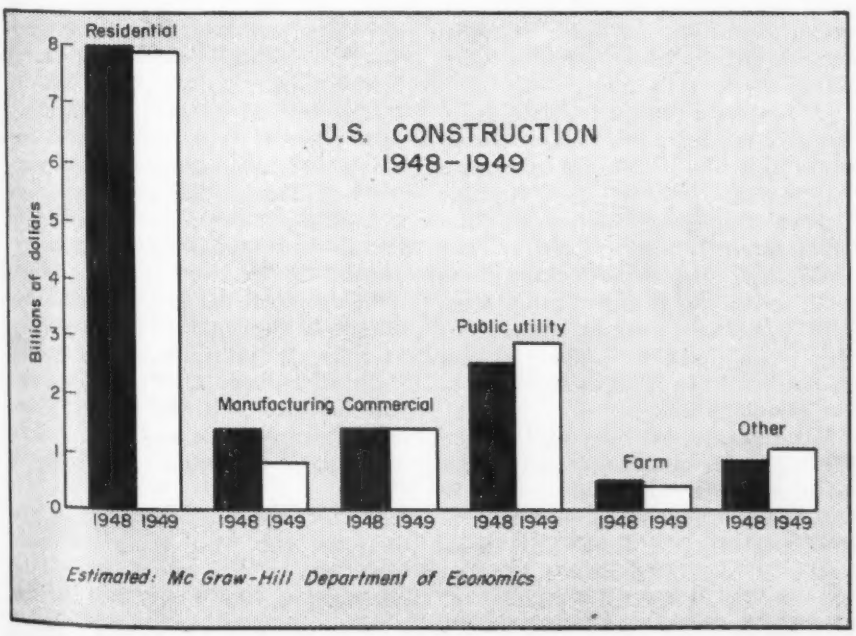
The number of churches, schools, institutions, hospitals, hotels, and miscellaneous structures being built is gaining fast. This year's $900,000,000 total is likely to rise to $1,100,000,000 in 1949. Since the end of the war institutions have been busy raising money for new construction. Prosperous conditions have aided them. Now that they have the money, they will build. Church construction in 1948 has been 90% above last year.

More Public Works in 1949

Even before the election, estimates of public construction were close to $5,000,000,000 for 1949, a billion more than in 1948. The defeat of the economy-minded Republicans may possibly increase the 1949 figure. But all indications are that the nation's bill for construction, both private and public, will climb from $18,500,000,000 in 1948 to better than $19,000,000,000 in 1949.

This continued high rate of construction means a great deal to the electrical industry. To utilities it means there will be no slackening in demand for electricity. The new homes, industrial plants, commercial buildings, and institutions will mean more customers, more demand. The need for building materials and for equipment and furniture for the new structures will keep industrial activity at a high level. This means that sales of electricity to industrial customers will stay high, probably even increase.

For the electrical manufacturers, a



good market is assured. Utilities will buy as heavily as ever. New manufacturing plants can't do without money-saving electrically driven equipment. Commercial buildings will offer a market for lighting equipment, air conditioning, and elevators. New homeowners will want electric appliances. And wire and cable manufacturers may expect a sellers' market, for what good is electricity without adequate wiring?

•

NARUC Head Advocates Material Allocation Probe

A Congressional investigation of private industry's voluntary method of allocating critical materials and the attendant rise in black market activities has been advocated by Walter R. McDonald, president of the National Association of Railroad and Utilities Commissioners.

In his annual report to the Association at its meeting this week at Savannah, McDonald also pointed to the petroleum industry as one whose out-of-line prices should be investigated. "In many instances," he said, "electric utility rate increases have been made absolutely necessary in order to offset the increased price of fuel oil exacted by an industry which is already receiving excessive earnings when measured by any standard."

Electrical transformers were the one item of electric utility equipment which he singled out as being in such short supply that utilities are unable to secure enough to furnish adequate service or to extend facilities.

•

Pacific P&L Construction to Cost $2,000,000 in 1949

Pacific Power & Light Co has announced it will spend more than $2,000,000 next year in Yakima County, Wash., for construction work, as compared with $1,248,000 spent this year.

The program will include construction of a substation west of Yakima, installation of 115-kv circuit breakers at the Union Gap substation, rebuilding the Toppenish substation to double its capacity, construction of a substation at Grandview, building of additional switching equipment at Sunnyside, and construction of a 115-kv transmission loop to circle the Yakima area. The new loop, replacing a 69-kv line, will be the first step toward construction of three additional major substations at Yakima and one at Selah.

IN RECOGNITION of half a century or more of continuous service to the electrical industry, NEMA 50-Year Gold Certificates were presented by NEMA President W. C. Johnson, left, to W. N. Goodwin, center, and C. L. Peirce at annual meeting at Atlantic City

Equipment Sales Have Hit Peak, Johnson Warns NEMA Meeting

SIGNS THAT SALES of electrical equipment have reached or passed their peak and long-delayed postwar business development plans soon may have to be dusted off were seen last week at the annual meeting of the National Electrical Manufacturers Association in Atlantic City.

W. C. Johnson, vice-president in charge of sales, Allis-Chalmers Manufacturing Co and retiring president of NEMA, said the signs are "as clear as can be." He noted the 17½% decline in farm prices compared with a year ago, the tripling of department store advertising in the last three months, and the intensified sales activities of many retail groups.

A downward turn in business, Johnson said, will bring new dangers. Young executives, who have never operated a business in a period approximating "normal times," may overcorrect. Another threat is the readiness of "the champions of planned economy" to jump in and be "helpful". He urged NEMA members to fight against further regimentation of business as long as possible in an effort to restrict it to the planning stage.

That business has been good was indicated by Johnson's report that NEMA members' dollar volume of products in the scope of the organization will be $3,000,000,000 in 1948. This is an increase of some $400,000,000 over last year. In 1934 the NEMA members of that time had a volume of $434,000,000.

Commenting on the recent election's effect on business, Johnson expressed doubt that any slacking off that may occur will be as severe under the present administration as it might have been under another. This administration has shown no inclination to stem inflation, Johnson said. He noted that people always buy on a rising market. "I do not think this country will be what it could have been with the Republican party in power," he said, "but it is still worth fighting for."

NEMA's budget for 1949, approved at the meeting, reveals a 52.5% increase in funds allocated to engineering projects. This action indicates that during 1949 NEMA will increase its activity in the field of codes and standards, particularly those concerned with materials used in the manufacture of electrical apparatus. Allocations of funds to business development and public information projects were sharply reduced.

NEMA presented 50-Year Gold Certificates in recognition of half a century or more of continuous service to the electrical industry to W. N. Goodwin, vice-president (retired), Weston Electrical Instrument Co, and C. L. Peirce, chairman of the board of Hubbard & Co.

B. W. Clark, vice-president in charge of sales for Westinghouse Electric Corp, was elected by the board of governors as NEMA president for the coming year. New vice-presidents

GENERAL SALES CONFERENCE of SEE brought together manufacturers and utility men. Among them were, left to right, left panel: Roy H. Knox, manager of advertising and sales promotion, Birmingham Electric Co; Les M. Taylor, vice-president of Mississippi Power & Light Co and chairman of the conference; and L. C. Truesdell, vice-president, Hotpoint, Inc. Right panel: J. E. McCarthy, sales manager of Automatic Blanket and Sunlamp Division, General Electric Co; Harry Restofski, chairman of EEI Commercial Committee; R. S. Bell, Commonwealth & Southern Corp; and H. E. Cox, vice-president of Birmingham Electric and vice-chairman of the conference

chosen were D. F. G. Eliot, vice-president, Western Electric Co; C. W. Higbee, manager, Wire and Cable Dept, U. S. Rubber Co; Don G. Mitchell, president, Sylvania Electric Products, Inc; and E. E. Potter, vice-president, General Electric Co. Whipple Jacobs, president, Belden Mfg Co, was re-elected vice-president.

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Street Lighting Monopoly Charged in Indictment

Six corporations and seven of their officials have been charged by a federal grand jury in Cleveland with monopolizing the $10,000,000 a year street lighting industry.

Criminal indictments were returned against General Electric Co; Westinghouse Electric Corp; Line Material Co, Milwaukee; Union Metal Manufacturing Co, Canton, Ohio; Pacific Union Metal Co, Los Angeles; and Holophane Co, New York. Named as co-conspirators on a lesser scale were American Concrete Corp, Chicago, and Taper Tube Pole Co, San Francisco.

Four violations of the Sherman Act were charged: conspiracy to restrain trade, conspiracy to monopolize, attempt to monopolize, and actual monopolization. Officials of Westinghouse and Union Metal have already publicly denied the accusations, saying that their companies had "never knowingly violated" the anti-trust laws or any other laws in the sale of their products.

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Rainier Rejects PUD

Voters of Rainier, Ore, have rejected a move to establish a peoples utility district in the community.

Need for Broader Sales Promotion Stressed at Southeastern Meeting

SALES FORCES of utilities, electrical appliance manufacturers, and merchandisers will come into their own next year and be one of the most important and pampered organizations in the industrial economy. It will be up to merchandising sales techniques to move into consumer channels the tremendous productive capacity of industry. Attention and assistance will be directed toward salesmen to prevent clogging of pipelines.

Such was the opinion expressed at the annual General Sales Conference of the Southeastern Electric Exchange held at Atlanta, Oct 10-12. Speaker after speaker indicated the necessity of broadened sales promotional effort backed by aggressive advertising. With the exception of electric ranges and refrigerators, most lines of appliances are in plentiful supply. As 1949 approaches, the first two will be available for immediate delivery to consumers.

The three-day sales meeting was studded with optimism and backed by enthusiastic sales programs. There was no feeling that business was going into a tailspin because President Truman had been returned to office. Manufacturers served notice that they would turn out the appliances and expect utilities and dealers to sell them.

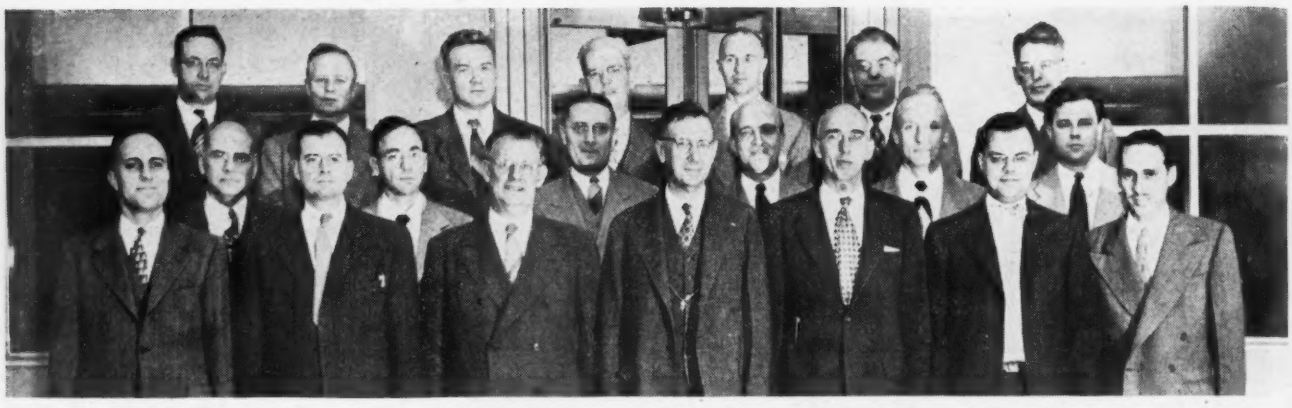
W. V. O'Brien, General Electric Co; L. C. Truesdell, Hotpoint, Inc; and T. J. Newcomb, Westinghouse Electric Corp, all agreed that there was little likelihood of price reductions. A fourth round of wage increases probably would bring higher prices, since manufacturers cannot absorb any further increase in material and operating costs.

Laurence Wray, editor of *Electrical Merchandising*, urged that utilities take the lead in arranging meetings between electrical dealers and plumbers to iron out the present conflict on installation of piped-in appliances.

Government hydro and multipurpose projects were discussed by Charles A. Collier, vice-president, Georgia Power Co. He suggested that the government is in a better position to construct the projects but the utilities should distribute the power.

Salesmen were praised by J. F. Crist, vice-president, Southern Co. He said that they were needed in the utility industry to sell its story to the public, to sell financing to the bankers so that necessary funds could be raised for construction, and to sell better electric living. A tipoff to what is needed to move equipment and appliances was given by Elon G. Borton, president and general manager of Advertising Federation of America. Borton said that advertising represents only 1.9% of the nation's total income and less than 1% of total sales. The present $3.8 billion advertising budget must be upped to $5 billion if consumer sales are to be sufficiently stimulated to move total production in 1949.

As an indication of what the electric utilities are preparing, Harry Restofski, Edison Electric Institute, gave a preview of the EEI promotion campaign on the all-electric kitchen. He said that if every kitchen were all-electric, it would require $35 billion worth of appliances and 165 billion kwhr a year in addition to present requirements, to keep them operating. Additional utility revenue of over two and a third billion dollars would result.



RADIANT HEATING Committee of American Institute of Electrical Engineers were guests of Ford Motor Co at its Lincoln-Mercury Division Plant at St. Louis. Meeting was intended to celebrate the tenth anniversary of radiant heating first installed at the company's River Rouge Plant. Left to right, front row: W. H. Wagner, L. E. Cole, E. J. Bates, L. E. Stout, J. E. Johanson, Earl Benson, V. G. Richardson, Ford Motor Co. Middle row: P. O. Blackmore, W. H. Wannamaker, Committee Chairman Paul H. Goodell, Committee Secretary C. E. Russell, O. C. Wallace, C. A. Casey. Black row: I. J. Barber, C. Heaton, E. A. Linsday, J. E. Sump, R. J. Might, W. F. Hickes, C. T. Prendergast

Conservation Agencies Approach Agreement on Northwest Planning

FEDERAL AGENCIES concerned with resource development in the Pacific Northwest are nearing agreement on their regional planning. They are expected to present a united front in asking Congress next year to authorize and appropriate for multipurpose dams, power transmission facilities, and lesser river improvement projects.

Their objective is threefold. For the long range, they hope to stop or alleviate disastrous floods and to exploit fully the area's irrigation and conservation potential. They also have an anxious eye on members of Congress who might demand a Columbia Valley Authority.

Latest indication of the new harmony among the conservation agencies was last week's report of the Army's division engineer at Portland. His recommendations called for a 20-year, $3-billion development program to be carried out by the Engineers, Reclamation Bureau, Agriculture Department, Bonneville Power Administration, and the Fish and Wildlife Service.

The report suggests that field representatives at least of the Engineers and the Reclamation Bureau have settled some of their longstanding differences. For example, it recommends that the Bureau establish additional reservoir storage and other flood control facilities at existing and future reclamation projects. The Engineers stop short of accepting the Bureau's proposal for a single basin-wide accounting system for all federal projects. But they agree that power revenues from both their own and Reclamation projects can help carry irrigation development costs.

The report also endorses the comprehensive development plan sent to the President and Congress last June by the Reclamation Bureau. The latter program called for construction of 23 irrigation and multipurpose projects to cost an estimated $273,324,000. Bonneville Power Administration will need $462,699,000, the Engineers estimate, to build transmission facilities to the proposed power plants.

The Engineers cite seven new multipurpose projects for which they will request "immediate authorization." Total cost of the seven, each with generating facilities, is estimated at $1,699,421,000. The projects and their locations follow:

Libby, Kootenai River, Mont.; Albeni Falls, Pend Oreille River, Idaho; Priest Rapids, Columbia River, Wash.; Hells Canyon, Snake River, Ore. and Idaho; John Day, Columbia River, Ore. and Wash.; The Dalles, Columbia River, Ore. and Wash.; and Glacier View, Flathead River, Mont.

The Hells Canyon project presents the only apparent conflict in Army and Reclamation Bureau plans for the region. The Bureau wants to build it, too. The Engineers propose to build the Glacier View project if the Secretary of the Interior concurs in their plans.

The division engineer's proposals will be held up in Washington for comment by interested parties. Then they will be sent to the basin states, the Departments of Interior and Agriculture, and Federal Power Commission. The Budget Bureau will get the final whack at it before it goes to Congress, probably in the spring.

BPA Reduces Power for 5 Aluminum Plants

Growing power shortages in the Pacific Northwest have caused the Bonneville Power Administration to cancel interruptible contracts for 82,000 kw of load to five aluminum plants.

Serious drops in stream levels of the Lower Columbia and Snake Rivers necessitated immediate cutbacks, Paul J. Raver, Bonneville administrator, explained. "There is little prospect that any of the cuts can be restored until next spring in view of other firm power commitments," he said.

Cutbacks include Aluminum Co of America, Vancouver, Wash., plant, 42,200 kw; Permanente Metal Corp, Spokane, 32,800 kw; Reynolds Metals Co, Longview, Wash., 6,000 kw; Electro-Metallurgical Corp, Portland, 1,000 kw.

C. S. Thayer, works manager of the Alcoa plant at Vancouver, said the shutting off of interruptible power will mean a cut of 25% in production. The plant has been operating five pot lines on a three-shift basis.

The Reynolds plant at Troutdale, Ore., will not be affected by the order, since it is being operated on power not exceeding its firm contract. Production at the Longview plant is expected to be affected to the extent of about 9%.

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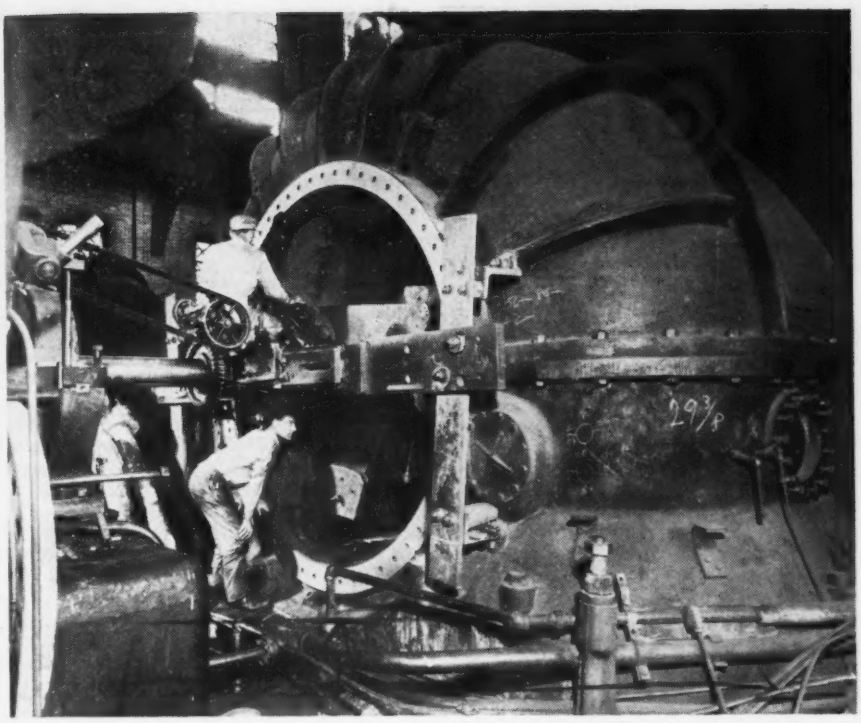
Florida P&L Adding Unit

Florida Power & Light Co has started steps to install another generator at its Riviera Beach station, nearly doubling the capacity. The Riviera station was put into service last year. The new 44,000-kw unit, due to go into service in 1951, constitutes the sixth major expansion project in the company's $85,000,000 program.



EXHAUST CHAMBER of 35,000-kw turbine at Kent Avenue Plant of New York's Brooklyn-Manhattan Transit System is rebored by Todd Shipyard workers. Portable boring bar is used for the refinishing and to prepare turbine for the insertion of stainless steel strips in way of inner casing flanging and supports. Casing of 25-year-old turbine was badly eroded

Wisconsin Association Discusses Capacity Expansion, Plant Costs

AN 88% INCREASE in generating capacity within the next six years in Wisconsin, factors which assist in holding down new plant cost, and reasons for rapid growth in domestic loads were discussed last week at the meeting of the Wisconsin Utilities Association at Milwaukee.

Wisconsin utilities will invest more than $200,000,000 in new plants in the six-year postwar period and about $75,000,000 in transmission facilities. "These figures," Association President W. E. Schubert said, "have been based on an incomplete survey which shows 11 companies will add 795,125 kw of steam, 119,300 kw of hydro, and 12,340 kw of internal combustion capacity, a total of 926,765 kw."

Edwin Vennard, vice-president, Middle West Corp, stated that the cost increase in most of the items that go into making electricity has been nearly in direct proportion to the wholesale price index. Indicating that many companies will have to increase their rates, he pointed out that since 1933 gross revenue has approximately doubled but the dollars available for return on investment are still about the same. He attributed the sound financial position of the industry during this period to the fact that investment did not increase between 1933 and 1939 and that the cost of money declined from 1939 through 1946.

Factors which tend to hold down unit costs of steam plants are site, buildings, equipment, and miscellaneous, W. A. Pollock, Wisconsin Electric Power Co, stated. Legislation has recently become an added factor in increasing investment and operating costs of both new and old plants. More and more communities are requiring installation of dust elimination equipment.

Savings in the cost of hydro power plants, according to J. K. Babbitt, Wisconsin-Michigan Power Co, are possible through careful study of the dam site and the selection of the most economical type of dam for the site.

The disappearance of the servant class from the American home has created a new market for many labor saving appliances, James J. Nance, president of Hotpoint, Inc, asserted. Appliances are needed by the housewife to replace the servant, and the servant who now has a better paying job in industry has the money to buy the appliances to make her own work easier. A similar situation exists on the farm, where the hired hand has left, creating a demand for labor-saving machinery. These changes will have a marked effect on customer demand for energy, which Nance believes will be 2,100 kwhr in 1955.

In discussing grounding, Eric T. Gross, Illinois Institute of Technology, stated that "on power systems it appears that solid neutral grounding is the preferred practice at voltages higher than 110 kv but some kind of fault-limiting device is preferable at lower voltages. It seems that resonant neutral grounding through the use of ground fault neutralizers is the most satisfactory method for transmission and distribution systems."

Television interference, outside of the receiver itself, is being blamed on the electric utility, T. J. Bailey, Wisconsin Electric Power, asserted. When such interference arises, dealers advise the complaining owner to call the utility. "We must be prepared to meet this problem regardless of whether or not we are at fault," Bailey said.

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Arizona's Right-to-Work Law Given New 'Teeth'

Enforcement "teeth" for Arizona's right-to-work bill were approved as a referendum measure in the state's general election by nearly a two-to-one margin.

The right to work bill, approved as a constitutional amendment in 1946, provides that no one should be denied the right to work because he does not belong to a labor union and prohibits closed shop contracts. The new enforcement measures prohibit jurisdictional strikes and authorize court injunctions in labor disputes if anyone is injured as the result of a strike.

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Private Utility Will Buy Missouri Municipal Plant

City officials and voters of Jamesport, Mo., have authorized the sale of the city's municipal electric system to Missouri Public Service Corp for $20,000. At the same election the voters approved a 20-year franchise grant to the purchasing company, requiring the utility to rebuild the system completely in a year.

Sale was made because the system was in bad repair and was so inadequate that service for heating appliances could not be supplied. The city had been faced with a new bond issue of $60,000 for necessary rehabilitation.

NEW 35,000-KW topping turbo-generator installed at the West End Plant of the Cincinnati Gas & Electric Co, is inspected by Floyd Martin, left, field engineer; William Murray, superintendent of the plant; and D. S. Brown, vice-president in charge of electrical production

Additional Funds Slated for Construction Work

President Truman is taking steps to carry out his campaign pledges to speed up federal power, reclamation, and flood control construction. He'll have a supplemental appropriation bill seeking more funds for such programs ready for Congress in January.

On White House orders several agencies quietly have prepared estimates of funds they want. This week they conferred just as quietly with the Bureau of the Budget on their requests.

Though proportions of the supplemental bill are not known, it is expected that it will be patterned after similar appropriations the President requested from Congress last July. That message, which Congress ignored, called for deficiency funds of $32,412,000 for civil functions of the Army Engineers, $17,000,000 for the Reclamation Bureau, and lesser amounts for Tennessee Valley Authority and the Southwestern Power Administration.

This time the total money requested will be much more. And there will be similar policy recommendations. The President is almost certain to ask again for removal of restrictions imposed on Reclamation Bureau operations in the Interior Department Appropriation Act passed by Congress last summer.

These restrictions included a provision that would stop the pay of Reclamation Commissioner Michael Straus and Regional Director Richard Boke next January. Possibly in anticipation of such Presidential action, Straus has assured friends that he will not leave his job.

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Power Tunnels Taxable Is Final Canadian Ruling

Power tunnels are more than holes in the ground. They are taxable improvements. That is the ruling of the Supreme Court of Canada.

The court upheld the British Columbia government's right to tax property owned by three power companies, reversing a decision of the B. C. Court of Appeal and confirming a decision of the B. C. Court of Revision.

The companies are the Bridge River Power Co, Vancouver Power Co, and Burrard Power Co, all subsidiaries of the B. C. Electric Railway Co.

The appeal to the Supreme Court involved five power tunnels upon which assessments totalling $1,938,643 had been placed by a court of revision, and certain transformers and equipment at Bridge River. The latter were ruled non-taxable.

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Utility Garage Burned

Loss was estimated at $165,000 in a recent fire that razed the Central Illinois Light Co garage in Springfield. Destruction of 42 trucks accounted for most of the $90,000 equipment loss. Damage to the building was set at $75,000.

SEC RULINGS

Kansas Power & Light Co and Missouri Power & Light Co's recapitalization plan that would increase the voting power of their parent, the North American Light & Power Co, and permit the filing of a consolidated tax return by the three companies has been approved. Under the recapitalization proposed for Kansas Power, the par value of its common stock would be reduced from $10 to $5 a share; authorized shares would be increased from 2,000,000 to 4,000,000; and 3,100,000 of such new shares would be issued in exchange for the 1,500,000 shares now held by North American Light & Power. This would increase Light & Power's voting power from 91.79% to 95.72%. As to Missouri, the par value of its common stock would be reduced from $20 to $5 a share; authorized shares would be increased from 375,000 to 1,500,000; and 1,060,000 new shares would be issued in exchange for 265,000 shares now outstanding and held by Light & Power. This would increase Light & Power's voting power from 86.89% to 96.36%. (Release No. 8625).

Southwestern Gas & Electric Co, Arkansas Power & Light Co, and their affiliate, The Arklahoma Corp, have received commission approval of their jointly filed application-declaration and amendments thereto. Arklahoma proposes to sell certain utility equipment, designated as nine capacitors, for a cash consideration of $17,000 each or a total of $153,000 Arkansas proposes to acquire six of the capacitors at an aggregate purchase price of $102,000, and Southwestern proposes to acquire three of the capacitors at a total price of $51,000. Gross proceeds from the proposed sale, amounting to $153,000, will be applied toward the retirement of the outstanding first mortgage bonds of Arklahoma or for acquisition of the property in the nature of renewals, replacements, or additions which may be required for the proper operation of Arklahoma's facilities. (Release No. 8622).

Pacific Power & Light Co has been authorized to borrow $3,500,000 from the Mellon National Bank & Trust Co of Pittsburgh, Pa. The loans will be made on 2¼% promissory notes due Aug 15, 1949, and will be repaid from cash to be obtained from permanent financing. Pacific Power will use the loans for construction expenses. (Release No. 8627).

MEETINGS

PREVIOUSLY LISTED

American Society of Mechanical Engineers—Annual Meeting, Hotels Pennsylvania and New Yorker, New York, November 28-December 3.

National Exposition of Power and Mechanical Engineering—Grand Central Palace, New York, November 29-December 4.

National Electrical Contractors Association—Annual Meeting, Roney Plaza Hotel, Miami, Fla., November 30-December 3.

August Utility Peak Loads Hit New High for 1948

The aggregate of major electric utility system peak loads for August, 1948, was 47,460,000 kw, according to figures announced by the Federal Power Commission. The August total was greater than that for any of the first seven months of this year and only 0.2% below the record peak load total of December, 1947. August peak loads were about 4,385,000 kw or 10.2% higher than August of last year and 765,000 kw above July, 1948, total.

Corresponding energy requirements for August were 23,809,000,000 kwhr, a new record and 1.4% above the previous record of 23,486,451,000 kwhr for January, 1948. August energy requirements were 11.2% above those for August, 1947, and compared with 22,874,316,000 kwhr for the previous month.

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Appliance Salesmen Lead in Department Store Pay

Salesmen selling major electrical appliances like refrigerators, stoves, and washers earn the best pay in the country's department stores.

A survey last April by the Bureau of Labor Statistics covering stores in 16 big cities discloses that sellers of major electrical appliances get the highest pay among department store salesmen in 10 of the cities—Atlanta, Chicago, Dallas, Denver, New Orleans, New York, Pittsburgh, Portland, Ore., St. Paul, and Seattle. In Boston, Philadelphia, Providence, Toledo, and Washington their weekly earnings were surpassed by those of furniture and bedding salesmen. In Oakland, Calif., floor covering salesmen rated highest.

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Dredge to Add Power

Partial alleviation of the power shortage in Hamilton, Ont., will be obtained by tying up a Welland Canal dredge for the winter. The dredge has a 1,500-hp diesel generator.

Other News

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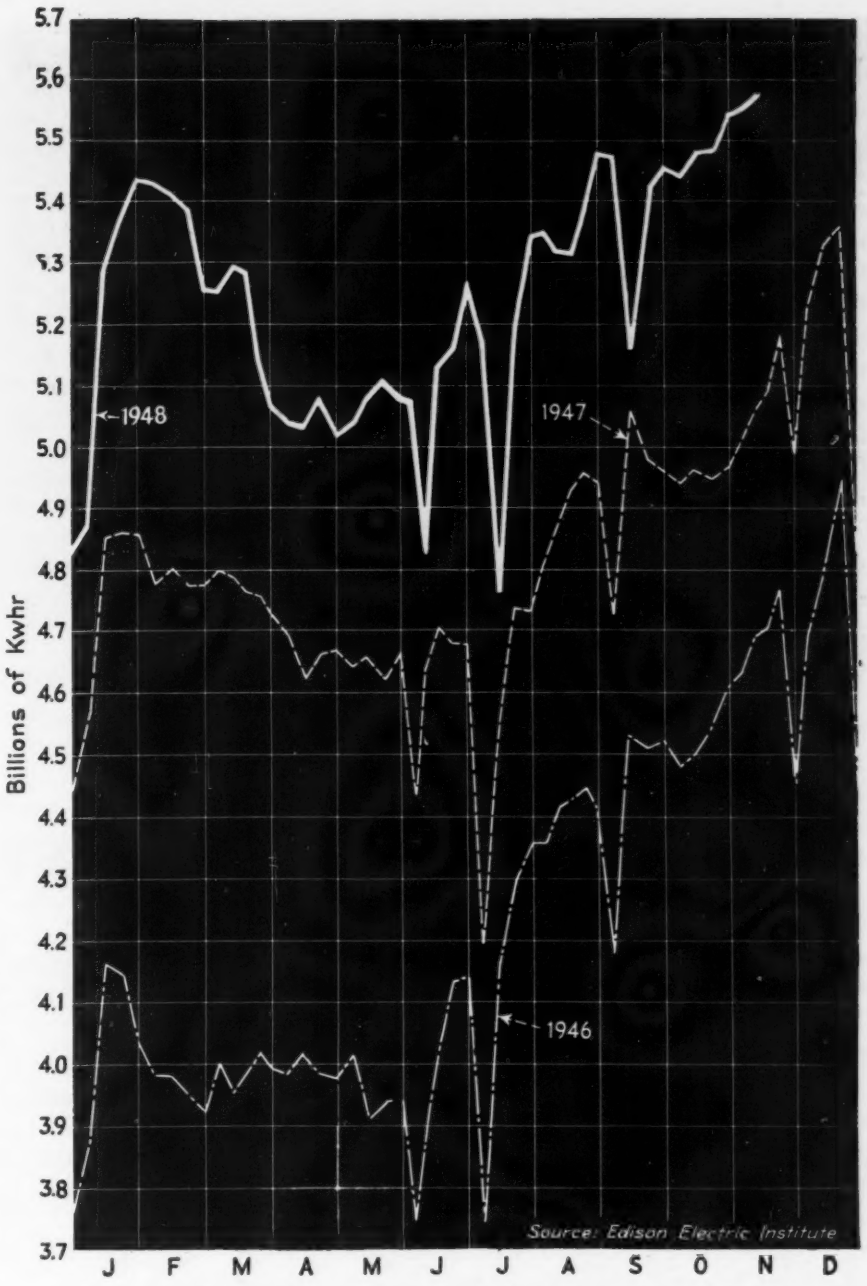


Output Running Only 9.6% above Last Year

For the nation's electric utilities good news came last week, but it came in a most unattractive package. The good news was that output for the week ended Nov 13 was only 9.6% above that for the corresponding week of 1947. The unattractive package was a record 5,570,767,000 kwhr, the sixth successive weekly record.

For the past four weeks, the increase over last year has been falling. The high point was the 11.6% for the week ended Oct 23. If this trend continues, the utilities will be able to approach December with a lot more confidence.

How much higher the output would have been if a number of energy producers had not curtailed energy deliveries to large industrial consumers on a voluntary or involuntary basis is not known. But at least Mr. Voter will get all the power he needs next month.

Weekly Output, Millions Kwhr

1948	1947	1946
Nov 13 5,571	Nov 15 5,084	Nov 16 4,700
Nov 6 5,564	Nov 8 5,057	Nov 9 4,682
Oct 30 5,555	Nov 1 5,009	Nov 2 4,628
Oct 23 5,539	Oct 25 4,964	Oct 26 4,602
Oct 16 5,482	Oct 18 4,946	Oct 19 4,540
Oct 9 5,482	Oct 11 4,958	Oct 12 4,495
Oct 2 5,449	Oct 4 4,935	Oct 5 4,478
Sept 25 5,461	Sept 27 4,956	Sept 28 4,518
Sept 18 5,426	Sept 20 4,977	Sept 21 4,507

Percent Change from Previous Year

	Nov 13	Nov 6	Oct 30
New England	+ 3.8	+ 3.4	+ 4.6
Mid-Atlantic	+ 5.0	+ 3.4	+ 6.8
Central Industrial	+ 8.3	+ 8.9	+ 9.6
West Central	+11.7	+10.1	+10.7
Southern States	+11.1	+13.3	+13.6
Rocky Mountain	+20.9	+21.2	+25.5
Pacific Coast	+13.6	+15.0	+14.4
Total United States	+ 9.6	+10.0	+10.9

WASHINGTON COMMENT

WILLIAM B. WHICHARD

AMONG OTHER THINGS the recent election nailed down as a virtual certainty a revival of some wartime controls for industry. President Truman repeatedly asked the 80th Congress to give him "standby" allocation and priority, price control, and other powers to use as he deemed necessary. He netted a voluntary allocation program and rent control extension, both due to expire in the near future. At this point, at least, it appears probable the new 81st Congress will give the President just about what he wants in the way of controls.

Government economists say that he almost certainly will demand allocations and priorities for materials and equipment essential for defense and foreign policy needs. Already two federal agencies are staging a behind-scenes scrap for authority to administer such powers. There is practically no talk of creating a new agency, a new WPB, to take over the job.

The Commerce Department, which set up the now dying voluntary allocation programs, is said to be the most likely recipient of any new allocation authority. But the National Security Resources Board, now finishing up its blueprint of a whole book of emergency controls for the next war, can't be counted out. NSRB would like to mastermind any new allocation program, if not actually put it into operation.

Many Truman advisors are calling for allocation by the government of materials flowing into key industries. They insist we cannot otherwise meet anticipated expansion of our rearmament program and our new and existing foreign commitments. Our military budget will increase next year and probably for several more years. Marshall Plan aid to Europe will cost less in dollars next year but probably take just as big a bite out of industrial output. Most important, however, will be the impact of new foreign aid —arms for Europe and possibly China.

Proportions of the projected arms lend-lease still are conjectural. From various official sources come estimates ranging from less than $1 billion to nearly $5 billion a year. Whatever the proportions, the new lend-lease could add up, together with other programs, to shortages of such vital materials as steel, copper, aluminum, lead, and other metals.

The present tight supply of steel is indicative of how easily essential metals might become "critical." The armed forces are buying about 1,230,000 tons per year at a cost of $1 billion. It might be estimated that a $5 billion lend-lease program would take about five times as much, or about, 6,000,000 tons of steel. That would be about a tenth of present output.

The real pinch then would be on production of certain types of finished steel. Steel shapes and plate certainly would be required in greater volume for any increase in arms production. Both already are in tight supply. No foreseeable expansion of mill facilities is likely to meet a really heavy increase in military demand for steel plate and shapes. Someone, and it almost certainly would be the government, would have to select "essential" and "non-essential" uses. Voluntary priority and allocation programs would not suffice.

There is some thought in Washington that only a few such controls will be necessary. That may be true if demand for critical materials does not leap far beyond productive capacity. But, as past experience proved, controls have a way of snowballing, once started.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Condensers discard into the river or harbor more than ⅔ the heat put into a plant's boilers. Too bad those Btu cannot be piped and sold for house heating.

Electronic applicants outnumbered power applicants 2 to 1 in one manufacturer's recent grist. Someone ought to tell prospective graduates of the undiminished opportunity to match the needs of the power art.

Pinch in oil supply could make some design engineers less enthusiastic about arranging boilers for dual fuel operation.

Gas turbines promise to be competitive with diesels in less than 5 years. Accelerated progress is attributed by one manufacturer to the fact that those working on the development are all young men, mostly in the twenties.

Socket-type watthour meters comprised 61% of the 1947 output. Ball-bearings and pivot bearings had a 6½ to 1 ratio. The 15-amp ratings outnumbered 5-amp ratings 16 to 1.

Contaminated oil accounted for 6.2% of the failures of a group of insured transformers, deteriorated insulation 18.5%, overload none.

Standard-rating turbines have won encouraging support except where larger sizes are needed or there is more advantage in duplicating a non-standard unit for expansion of an existing plant or continuing non-standard steam conditions.

Mobile radio transmitting stations deserve better housing than a flimsy unsightly construction-firm shanty. Technicians must maintain and even operate at the spot, possibly in the most inclement weather when radio service is at a premium.

METHODICAL TESTING AND CHECKING PROGRAM, somewhat curtailed to avoid deferring initial operation of Dayton's Hutchings plant, disclosed numerous defects and errors

Check, Test, Inspect Before You Start Up a New Plant

Adequate minimum program essential to successful initiation of operation . . . Only eternal vigilance will offset the careless attitude of construction employees

H. E. DEARDORFF
Vice-President
Dayton Power & Light Co

A TESTING PROGRAM was set up for the purpose of checking the electrical installations at the new O. H. Hutchings Generating Station of the Dayton Power and Light Company, preparatory to placing it in service. The time element involved in placing this station in service was of paramount importance because the Dayton Power and Light Company's system was deficient in generating capacity.

The plant is a completely new development located approximately ten miles south of the City of Dayton. Ground was broken in November, 1946, and the first turbine generator was placed in commercial service in July, 1948, 19 months later.

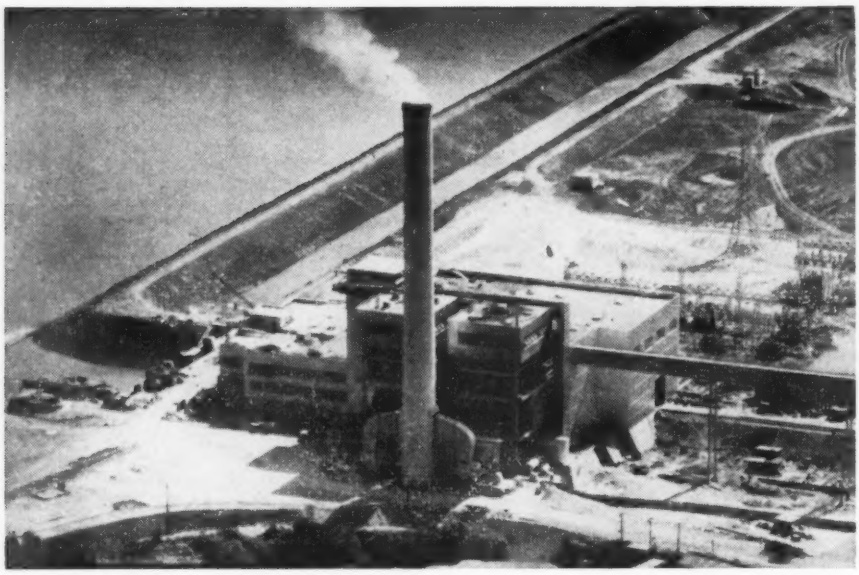
Adapted from paper before recent meeting of EEI Electrical Equipment Committee

Placing the first unit in service in this plant within a 19-month construction period constitutes somewhat of an achievement when one considers the trying situations which develop today due to material and labor supply and a host of other delaying factors. A testing program was designed to provide the necessary electrical tests to insure safe operation of the station. It should be considered somewhat of a minimum program which could be tolerated.

The first generator is a 60,000-kw 85% power factor 3600-rpm 12,500-v hydrogen-cooled machine and is equipped with a separate motor-generator exciter. The generator stator was meggered with a 2500-v Megger and the rotor was meggered with a 500-v Megger. The governor motor current was measured to determine the adequacy of control switch contacts since a number of cases of failure at this point have been experienced in the past. The windings of the motor and generator on the exciter were meggered with a 500-v Megger and all connections and wiring were verified and checked for tightness.

12-Kv Buses

The 12-kv phase isolated buses were given a 25-kv, 60-cycle high potential test from phase to ground. All joints were triple tested for tightness by the contractor's electricians, the



FIRST SEMI-OUTDOOR PLANT to be energized north of the Mason-Dixon line is Dayton's 60 Mw O. H. Hutchings plant. Two others are in progress at Athens, Ohio, and Port Jefferson, N. Y. (see Electrical World, Aug. 14, 1948, page 94)

Test Department and the station electricians. Through-type current transformers were checked in the laboratory for ratio and phase angle and a 2300-v high potential test was impressed upon the secondaries.

Power Transformers

Main power transformers were tested at the factory in the presence of Ebasco representatives for the company. When received on the job, the bushings were Doble-tested outside of the tanks whereupon a number of damaged condensers were found which required repairing at the manufacturer's service shop. Transformer windings were Doble-tested with the bushings out of the tank and the complete assembly with bushings reinstalled was then Doble-tested. Insulating oil was given a Doble test and a high potential dielectric test. The ratios were checked with a Murray ratio bridge. High potential facilities in excess of 30 kv at 60 cycles were not available on the site.

One 7500-kva, 3-phase, 69/2.3-kv, oil insulated, self-cooled auxiliary transformer is utilized for "cold" starting up of the station or emergency service. This transformer was given somewhat the same treatment as the main power transformer.

Each generating unit will also have a 6,000-kva, 3-phase, 12/2.3-kv, oil insulated, self-cooled auxiliary transformer directly connected to the 12-kv bus leaving the generator terminals for the purpose of supplying auxiliary power for the unit. This transformer is equipped with a 12-kv pothead compartment in which the single conductor, lead sheathed cables terminate in potheads immersed in oil, and a 2.3-kv pothead compartment in which the 2.3-kv Kerite single conductor cables terminate in stress cones in air. This transformer was tested similarly to the other transformers with the exception of the pothead terminals. In this case the cables were meggered and phased out.

There are a number of 750-kva, 2300/440-v auxiliary power transformers supplying load centers. These transformers are of the dry type and were given a Megger test when connected to the 2300-v incoming cables. A ratio check was also made.

Auxiliary Power Boards

Circuits to 2300-v motors and 2300/440-v power distribution centers were given a 5-kv high potential test with all breakers in position and closed and all instrument transformers energized. All current and potential transformers were tested in place for ratio and phase angle. The secondaries were meggered. Relays were calibrated and tested in the laboratory. Representative air circuit breakers were checked by a factory man and the remainder were checked by the contractor's electricians assisted by the Test Department and station electricians. These breaker inspections included a check for contact alignment and condition; operating mechanism alignment, freedom of operation, lubrication, etc.; alignment of breaker trucks in cubicles and alignment of control circuit jacks; and in addition a measurement of the closing and tripping currents. All control and power wiring was verified and checked for tightness of connections.

Control Boards

All wiring was verified and connections checked for tightness. All indicating instruments measuring current, voltage, watts and vars, and synchroscopes, were checked in the laboratory. Recording instruments were likewise checked. All relays were tested and calibrated and final settings made in the laboratory in accordance with calculated values. After being returned to the board, all relays were test loaded and checked for tripping operation. No field calibration was made. Carrier current transmitters were set up and tuned in the field with a Link carrier oscillator. Sequential timing tests of carrier current relays are yet to be done by oscillograph.

Instruments and meters on the boiler and turbine control boards were shipped in place and suffered considerable damage in transit. This consisted of movements jumping out of bearings, bent pointers, etc. The ammeters and wattmeters on these boards were all removed and checked in the laboratory but other instruments, such as speed and position indicators, were checked in place. The L & N recorders were checked by a factory representative as were the Bailey meters. The turbine supervisory instrument was checked (point to point) by the test department.

Control Wiring

No Megger tests were made on control wiring due to the time element involved and the fact that there were a great many people working on these circuits all at one time. All wiring was verified and checked for tightness of contacts. In connection with the installation and checking of the control cables, a scheme was developed which greatly simplified the process of installation and checking and really saved a great deal of time. This method consisted of placing a

tag on each terminal block showing the color of the conductor which was to be attached to each terminal and designating the terminal notation. Control cables were then pulled and connected to the terminal blocks in accordance with the color scheme and terminal designation indicated on the tag. The Test Department next tested the continuity of only one conductor in each cable in order to verify the two terminal ends. The colors were then verified with the tag, and the tightness of the connections checked. After this inspection, an additional tag was placed on each end of the cable giving its number, the location, the date checked and the name of the checker. A duplicate stub was then torn off and filed in the field office. These were used merely as a temporary record for the installation, and greatly assisted in checking the progress of the work. Many hours installation and checking time were saved. By this method, 300 control cables were installed and checked in approximately five days.

Power Wiring

All 2300-v cables were tested with a 1000-v Megger. All 440-v cables were not meggered due to lack of time. In all cases where 3-conductor cables were used, the conductors were color coded and standard phasing was employed.

A small carrier-current battery was shipped upside down and numerous jars were broken, requiring factory replacement. One of the large control battery jars was broken and required replacement, and two others were upside down and partially dry. In one instance, a welder working in the battery area, (which had not yet been walled off into a room by partitions), allowed sparks to drop on top of one cell causing an explosion in the jar, blowing off the top. This happened despite the fact that he had been repeatedly warned about the hazard involved.

The battery chargers were checked for wiring verification, tightness of connections and in all instances required field flashing.

Auxiliary motors range in size from fractional to 2000 hp and are rated 110, 440 and 2300 v, 3-phase. All 2300-v motors were meggered upon arrival. An attempt was made to utilize motor terminal designations to secure standardized phase connections and proper motor rotations, but in this respect, was only about 60% successful. Some motors were unmarked and there was lack of uniformity of designation among manufacturers, which made it impossible to depend upon phase rotation.

Protective Devices

Minimum current or voltage pick up of various contactors, relay armatures, etc. was measured. This test provided an excellent check on their condition, since faulty assembly, workmanship or mechanical damage is shown up in this manner and can be corrected before being placed in service. Automatic throwover features were tested by means of a simulated test with auxiliary breakers placed in the test position. Live tests on this feature were made after the equipment was placed in operation.

Practically all indicating lamps that were shipped in place on the control boards had broken filaments and required replacement.

The tripping settings on breakers supplying auxiliary motors were classified into three groups. The first, included all 2300-v motors which are equipped with individual air circuit breakers and induction long-time-delay overcurrent relays. These were set for tripping at 125 to 150% full load motor rating, with instantaneous tripping attachments set at 8 times motor rating. Group two includes all the 440-v motors equipped with dual thermo-magnetic tripping devices and air circuit breakers. In these cases, time current curves were compared to motor insulation damage curves and dial settings for overload protection selected to give values below the damage point. Instantaneous tripping is 12 times breaker rating. The third class includes all the 440-v air circuit breakers supplying circuits to the various 440-v load centers. These breakers have oil film time delay tripping with instantaneous trip at 12 times breaker setting. It was necessary to coordinate the settings of these breakers with the numerous individual motor breakers which were supplied through the load centers.

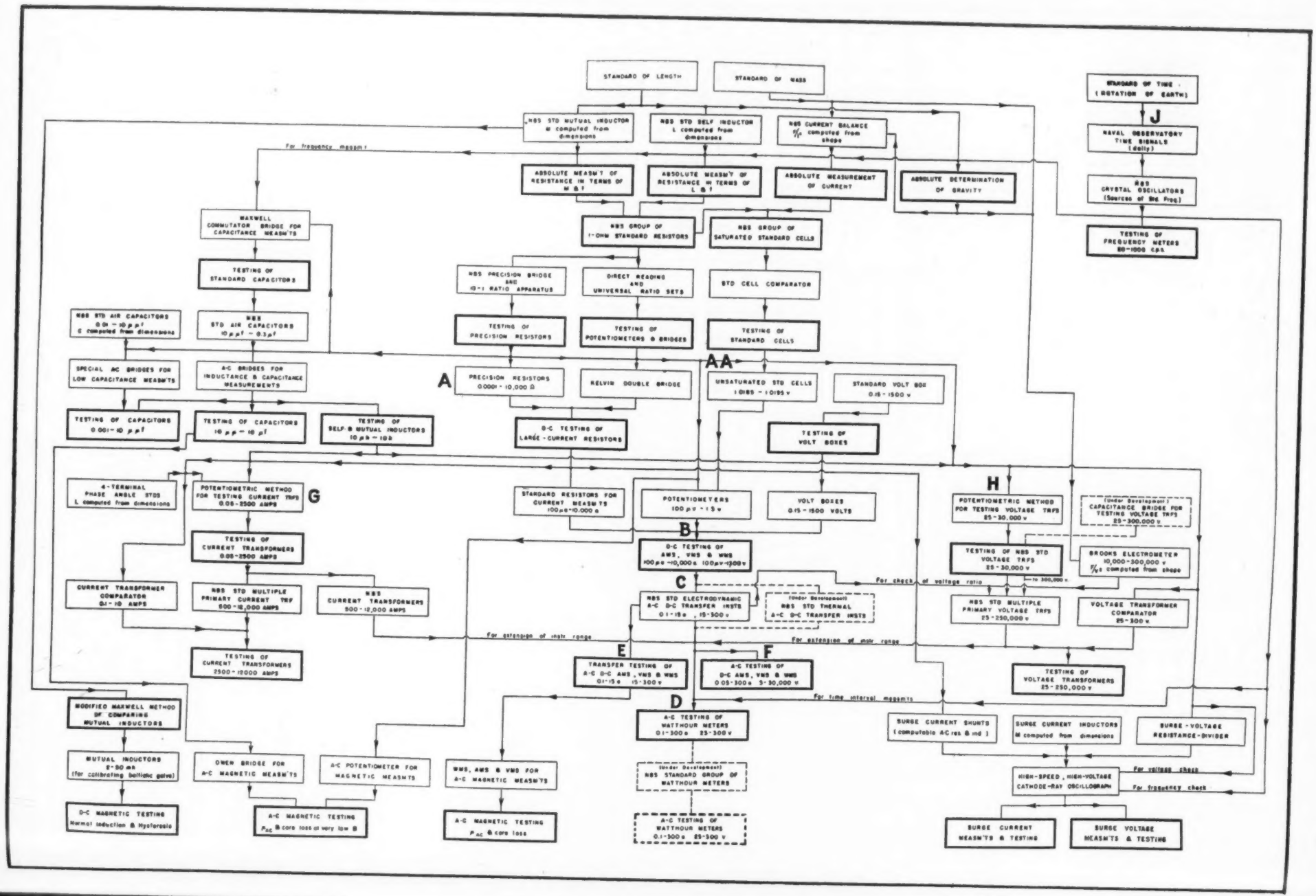
An amazing lack of responsibility on the part of the contractors' workmen employed on the project was experienced. Almost unbelievable acts were committed by workmen which greatly jeopardized equipment and property and required eternal vigilance on the part of those in charge to police areas after the workers left. Electricians would leave oil circuit breaker operating cubicles standing wide open, exposed to the weather in the outdoor substations. The welders would toss pieces of welding rods in all directions regardless of where they might fall, and in numerous instances they could have fallen into motors in operation and damaged windings. Doors on power centers were removed for refinishing, leaving the contents exposed to glass wool and fibers from pipe coverings. Sweeping operations were performed without dust inhibitor being used, resulting in clouds of dust being raised around relays and control equipment. In another instance, painters working on the generator sprayed filler and grinding compound on the open collector ring end, and so on ad infinitum.

Seven Outages

Since July of this year, when the plant was placed in operation, there have been seven forced outages. Four of these were of electrical origin, one of which was due to incorrectly connected differential relays protecting the generator, and the other three due to electricians becoming involved in energized control circuits and tripping auxiliary equipment. One outage was attributed to operational procedure in handling the pulverized coal burners which caused the fire to be blown out. Two additional outages were caused by economizer tube leaks.

When everything in general is considered, however, the conclusion is reached that a fine job was accomplished in a very limited period of time and under great difficulties. The plant was placed in service in a sort of open air atmosphere, with many building walls, windows and partitions missing, and with numerous operation hazards to life and limb due to holes in the floor, lack of stairs or temporary ladders and platforms.

In spite of all these difficulties the plant has settled down to its daily task of grinding out kilowatt hours, in anticipation of the assistance of No. 2 unit which is expected to be put in service about March 1.


STANDARD OF LENGTH
STANDARD OF MASS
STANDARD OF TIME (ROTATION OF EARTH)
J
NAVAL OBSERVATORY TIME SIGNALS (daily)
NBS CRYSTAL OSCILLATORS (Sources of Std. Freq)
TESTING OF FREQUENCY METERS 50-1000 c.p.s.
NBS STD MUTUAL INDUCTOR M computed from dimensions
NBS STD SELF INDUCTOR L computed from dimensions
NBS CURRENT BALANCE f/r computed from shape
For frequency measmt
ABSOLUTE MEASM'T OF RESISTANCE IN TERMS OF M & T
ABSOLUTE MEASM'T OF RESISTANCE IN TERMS OF L & T
ABSOLUTE MEASUREMENT OF CURRENT
ABSOLUTE DETERMINATION OF GRAVITY
MAXWELL COMMUTATOR BRIDGE FOR CAPACITANCE MEASM'TS
NBS GROUP OF 1-OHM STANDARD RESISTORS
NBS GROUP OF SATURATED STANDARD CELLS
TESTING OF STANDARD CAPACITORS
NBS PRECISION BRIDGE AND 10-1 RATIO APPARATUS
DIRECT READING AND UNIVERSAL RATIO SETS
STD CELL COMPARATOR
NBS STD AIR CAPACITORS 0.01 - 10 μμf C computed from dimensions
NBS STD AIR CAPACITORS 10 μμf - 0.3 μf
TESTING OF PRECISION RESISTORS
TESTING OF POTENTIOMETERS & BRIDGES
TESTING OF STANDARD CELLS
SPECIAL AC BRIDGES FOR LOW CAPACITANCE MEASM'TS
A-C BRIDGES FOR INDUCTANCE & CAPACITANCE MEASUREMENTS
A
PRECISION RESISTORS 0.0001 - 10,000 Ω
KELVIN DOUBLE BRIDGE
AA
UNSATURATED STD CELLS 1.0185 - 1.0195 v
STANDARD VOLT BOX 0.15 - 1500 v
TESTING OF CAPACITORS 0.001 - 10 μμf
TESTING OF CAPACITORS 10 μμf - 10 μf
TESTING OF SELF & MUTUAL INDUCTORS 10 μh - 10 h
D-C TESTING OF LARGE-CURRENT RESISTORS
TESTING OF VOLT BOXES
4-TERMINAL PHASE ANGLE STDS L computed from dimensions
POTENTIOMETRIC METHOD FOR TESTING CURRENT TRFS 0.05-2500 AMPS
G
STANDARD RESISTORS FOR CURRENT MEASM'TS 100 μΩ - 10,000 Ω
POTENTIOMETERS 100 μv - 1.5 v
VOLT BOXES 0.15 - 1500 VOLTS
H
POTENTIOMETRIC METHOD FOR TESTING VOLTAGE TRFS 25-30,000 v
(Under Development) CAPACITANCE BRIDGE FOR TESTING VOLTAGE TRFS 25-300,000 v
B
D-C TESTING OF AMS, VMS & WMS 100 μΩ - 10,000 Ω 100 μv - 300 v
TESTING OF NBS STD VOLTAGE TRFS 25-30,000 v
BROOKS ELECTROMETER 10,000-300,000 v f/r computed from shape
TESTING OF CURRENT TRANSFORMERS 0.05-2500 AMPS
C
For check of voltage ratio
to 300,000 v
CURRENT TRANSFORMER COMPARATOR 0.1 - 10 AMPS
NBS STD MULTIPLE PRIMARY CURRENT TRF 500 - 12,000 AMPS
NBS CURRENT TRANSFORMERS 500 - 12,000 AMPS
NBS STD ELECTRODYNAMIC A-C D-C TRANSFER INSTS 0.1 - 15 v, 15 - 300 v
(Under Development) NBS STD THERMAL A-C D-C TRANSFER INSTS
NBS STD MULTIPLE PRIMARY VOLTAGE TRFS 25 - 250,000 v
VOLTAGE TRANSFORMER COMPARATOR 25 - 300 v
For extension of instr range
For extension of volt range
E
TRANSFER TESTING OF A-C D-C AMS, VMS & WMS 0.1 - 15 v 15 - 300 v
F
A-C TESTING OF D-C AMS, VMS & WMS 0.05 - 300 v 5 - 30,000 v
TESTING OF VOLTAGE TRANSFORMERS 25 - 250,000 v
For time interval measmts
D
A-C TESTING OF WATTHOUR METERS 0.1 - 300 v 25 - 300 v
SURGE CURRENT SHUNTS (computable A-C res & ind)
SURGE CURRENT INDUCTORS M computed from dimensions
SURGE - VOLTAGE RESISTANCE - DIVIDER
MODIFIED MAXWELL METHOD OF COMPARING MUTUAL INDUCTORS
MUTUAL INDUCTORS 2 - 50 mh (for calibrating ballistic galvs)
OWEN BRIDGE FOR A-C MAGNETIC MEASM'TS
A-C POTENTIOMETER FOR MAGNETIC MEASM'TS
WMS, AMS & VMS FOR A-C MAGNETIC MEASM'TS
(Under Development) NBS STANDARD GROUP OF WATTHOUR METERS
HIGH-SPEED, HIGH-VOLTAGE CATHODE-RAY OSCILLOGRAPH
For voltage check
For frequency check
D-C MAGNETIC TESTING Normal Induction & Hysteresis
A-C MAGNETIC TESTING P_{ac} & core loss at very low B
A-C MAGNETIC TESTING P_{ac} & core loss
A-C TESTING OF WATTHOUR METERS 0.1 - 300 v 25 - 300 v
SURGE CURRENT MEASM'TS & TESTING
SURGE VOLTAGE MEASM'TS & TESTING

Basis of Standardization Of Electrical Instruments and Meters

Absolute values of electrical units, for calibrating instruments used by electrical industry, are established by the more fundamental mechanical units of length, mass and time

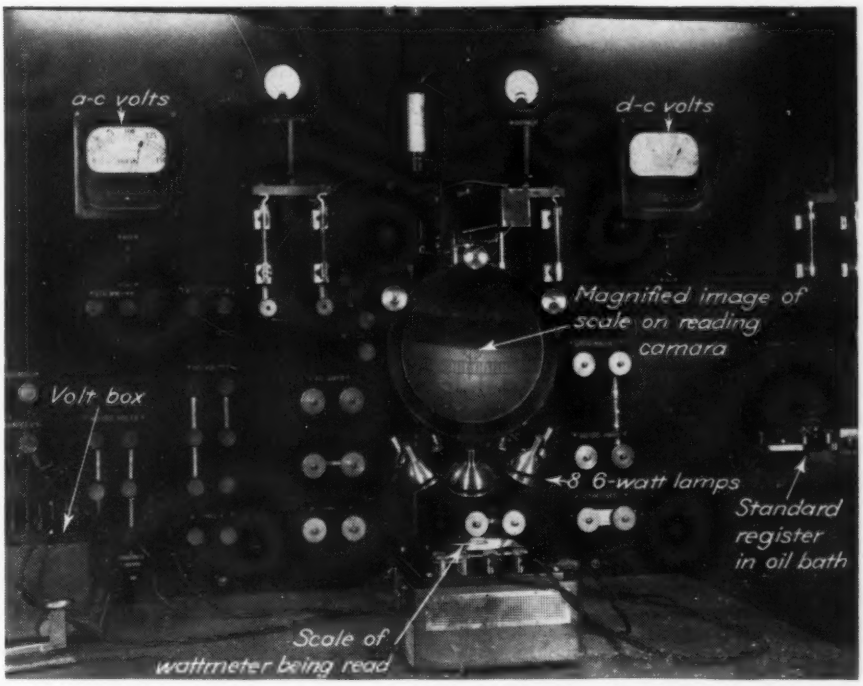
DR. F. B. SILSBEE
Chief, Division of Electricity and Optics
National Bureau of Standards

THE CHAIN of measurement by which the National Bureau of Standards determines the true value of each working standard from other standards of a more fundamental character is shown schematically in the chart. Blocks with light outline represent specific standard instruments or types of apparatus used for testing work. Blocks with heavy outline represent different types of standardizing measurements. Other than to check the working standards of the Bureau, most measurements are made on apparatus submitted by industry.

By international agreement and in conformity with Public Bill No. 105, of July 12, 1894, the electrical units are defined as those of the "absolute practical" or "meter-kilogram-second" system. Their values are established by absolute measurements that fix the relation between the electrical units and the fundamental mechanical units of length, mass, and time.

Such absolute measurements are a normal function of the larger national standardizing laboratories. They are seldom made elsewhere both because of their technical difficulty and because adequate accuracy can be obtained by having secondary standards tested at the national laboratory. The apparatus and processes used in the absolute measurements are shown by the six blocks at the top center of the chart.

←PROGRESSIVE STEPS in establishment and maintenance of absolute electrical units and dissemination of working standards



INSTRUMENT READING CAMERA or projector, provides an enlarged, conveniently located image of an instrument scale for greater sustained accuracy in instrument testing

The first step in establishing the ohm by absolute measurement is to construct an inductor (either mutual- or self-) the dimensions of which can be measured with great accuracy. From these dimensions and the permeability of the space surrounding the winding, the value of the inductance in absolute henries is calculated. The second step measures a resistor in a circuit at a known frequency in terms of this inductance, thereby establishing the value of its resistance in absolute ohms.

The first step in establishing the unit of electromotive force is to construct a current balance of accurately known dimensions. The electro-dynamic force developed by the current circulating in the coils of the apparatus is balanced by the force of gravity on a known mass. From this force, together with the measured shape and relative position of the coils, the value of the current in absolute amperes can be calculated.

A resistor in series with the coils, and therefore carrying the same current, is adjusted until the IR drop in it just balances the emf of a standard cell. The emf of the cell in absolute volts, then, is equal to the product of the value of resistance in absolute ohms and the calculated value of current in absolute amperes.

During the intervals between successive absolute measurements, the units of resistance and of electromotive force are maintained by primary groups of carefully constructed

standard resistors. Each standard is compared directly with the working standard used in the absolute measurement. Thus, a value in terms of the absolute unit is obtained for each member of the group and for the mean of all. Frequent subsequent intercomparisons are made between the individual standards in each group.

Any developing defect, drift, or unsteadiness in any one standard is detected as a shift in its value relative to the mean. If this occurs, another standard of high quality is substituted for the defective one and the assigned value of the mean adjusted to correspond. The value of one of the standards in the group used as a reference is assumed to remain constant between inter-comparisons. Also, the mean value for the group is assumed to be constant over the longer interval between absolute measurements.

Resistance Measurement

Measurement of a resistance standard is based on this group of precision resistors and can be made by use of a precision bridge and carefully calibrated ratio sets (5th row in chart) to a relative precision of one part in ten million. This can be done even though the accuracy of the absolute measurements is probably not as high as 20 ppm.

A resistance ratio of 10 to 1 also can be set up with this accuracy and used to step up and down successively so as to fix the values of precision resistance standards over the range from 10,000 ohms to 0.0001 ohm. Tests of standard resistors, resistance boxes, bridges, and potentiometers of various types are made by the Bureau's Resistance Laboratory on the basis of these standards.

With the NBS Standard Cell Comparator, the emf's of two standard cadmium cells can be compared within 1/10 μv. This device is used by the Electrochemistry Laboratory in the routine standardizing tests on unsaturated standard cells. By such means a large number of the electrical laboratories throughout the nation establish the values of their reference standards.

In addition, many laboratories send high grade laboratory standard ammeters, voltmeters, and wattmeters for test. Many utility companies, particularly those nearby, have their portable standard watthour meters tested. After calibration, such instruments and meters and their range-extending apparatus, which form the basic standards of these laboratories, serve in effect to transfer the electrical units from Washington to all parts of the nation.

Daily Working Standards

The precision resistors shown at *A* and the unsaturated standard cells shown at *AA* constitute the working standards used daily for testing indicating electrical instruments and meters. The junction at *B* symbolizes: (1) Use of a potentiometer with a standard resistor (or shunt) to measure current and to test ammeters; (2) its use with a volt-box to measure higher d-c voltage and to test voltmeters; and (3) its use with both to measure d-c power and to test wattmeters. For economy this second type of test normally is made by using separate sources of current and voltage.

The transfer from direct to alternating current, voltage, and power by the use of transfer instruments of the electrodynamic type is at *C*, and the combination of power and time to give values of energy is at *D*.

As this main stream of measurement proceeds and builds up standards for other quantities, various types of auxiliary apparatus contribute additional possibilities and continually increase its breadth and scope. Thus, the standard volt-box has within itself means for fixing and extending voltage ratios over a range of 3,000 to 1. The standard resistors for current measurements are constructed so as to have nearly the same resistance for large as for small currents, thus extending the range of current measurement. The transfer instruments of the electrodynamic type are constructed so that they have the same torque, and therefore reading, on a-c as on d-c, up to several hundred cycles per second.

The non-inductive standard resistors shown at *G* are used in the a-c potentiometric method for testing current transformers. These resistors have the same effective resistance on alternating current as on direct current. The residual inductances of these resistors are compared with those of the four-terminal standards of phase angle, which are of such shape that their phase angle can be accurately calculated from their dimensions. This fixes the inductances as well as the resistances of the "non-inductive" standards.

The further extension of the range above 2,500 amp is obtained by the standard multiple-primary current transformer. This transformer has (1) a ratio that varies strictly in proportion to the number of primary turns even when the number of primary turns is varied by a factor as great as 24, and (2) a phase angle that is substantially independent of the number of primary turns.

In the high voltage field, a similar increase in range is obtained by a shielded resistance potential divider. This is used in the a-c potentiometric method, shown at *H*, for testing voltage transformers. This divider is constructed so that its elements have the same effective resistance and inductance when connected in series as they have when tested separately. Therefore it serves to step the known voltage range up to 30,000 v.

Above 30,000-v Range

Above this voltage, standard multiple-primary voltage transformers (which can be calibrated with their primary coils in parallel and used with these coils in series) serve to step up the range to 250,000 v. The Brooks absolute high voltage electrometer of the attracted disk type, gives an independent check on measurement above 30,000 v a-c. It has confirmed the standard method to 0.01%.

Measurement of time intervals rests fundamentally on the astronomical work of the Naval Observatory, shown at *J*. These observations give the true value to be assigned to the frequency of certain crystal oscillators maintained by the Radio Division of the Bureau. Sub-harmonics of these oscillators give time signals in the form of short pulses spaced at intervals of exactly one second; or as continuous alternating current of exactly 60-cycle frequency. The first form of signal operates a relay system to automatically close the voltage circuit of the watthour meter under test at the beginning of one second

and, after a predetermined interval to open the circuit at the beginning of another second.

The second method operates timers driven by synchronous motors. They are started and stopped manually to record the time for the watthour meter under test to make a counted number of revolutions.

Transfer Testing

There is a difference between transfer testing of a-c ammeters, voltmeters, and wattmeters at *E* and the a-c testing at *F*. In the transfer test, the instrument under test and the standard transfer instrument are so connected as to respond to the same current, voltage, or power. An alternating current through both instruments is adjusted until the instrument under test comes to the desired scale point. The standard instrument is then read. Direct current is then applied to both instruments and again adjusted to give the same reading on the instrument under test. The direct current is then reversed and a third reading made, then a fourth reading is taken with alternating current again applied to both instruments.

By repeating this cycle of measurements, a series of sandwiched a-c and d-c readings is obtained and the difference between the mean of the a-c readings and that of the d-c readings of the standard instrument is computed from these data.

This procedure avoids all sources of error such as heating, shift of zero and reading error of either instrument. This leaves in the net difference only those errors from sources such as inductance, capacitance, and eddy currents, in which the effect on alternating current differs from that on direct current. The accuracy in such measurements approaches 0.02%.

In a straighforward a-c test the transfer instrument is first calibrated alone by applying direct current. It is then used as a standard and the readings of the instrument under test are compared with it. At the end of the measurements at each scale point the standard is again calibrated on direct current. This procedure has to be used with (1) a-c instruments that do not respond to direct current, and (2) with all instruments that exceed the range (10 amp, 300 v) of the standard transfer instruments. When necessary, instrument transformers extend the a-c range.

Any self-heating or zero shift of the instrument under test that occurs in the course of the straight a-c test is included in the final result. Thus the accuracy is definitely less than that of the transfer test. Many laboratories are equipped with potentiometers and standard cells, and so can determine the d-c performance of their instruments. Hence, the transfer test is the more useful and desirable test for accurately calibrating reference standard instruments.

Shunts used in the measurement of large direct currents can be measured while carrying a rated current by using the Kelvin double bridge and precision resistors of large current-carrying capacity. Heavy-current shunts include: (1) those designed so that the heat generated within them is dissipated in a definite manner by oil or forced air cooling, which is independent of the current leads; and (2) those that are cooled by conduction of heat along the current leads.

Two Methods for Shunts

In the first, the resistance of the shunt is a definite function of the current, the ambient temperature, and the temperature of the cooling medium. A test of such a shunt can well be made under conditions that closely duplicate those under which the shunt will be used.

In the second type, the temperature, and therefore the resistance, depend upon the quality of the current contacts and the nature and dimensions of the conductors connecting it to the circuit. It is impractical for the testing laboratory to duplicate all of these vital conditions and there is little merit in attempting to test such a shunt with full rated current. The usual procedure is to measure the resistance of the shunt at two or three different temperatures. The values are obtained by enclosing the shunt in a separately heated chamber with temperature control and using in test only enough current to give good sensitivity in the measurement. If its temperature is measured when the shunt is back in use, a fairly reliable value of the resistance of the shunt can be obtained by interpolating between the values obtained in the enclosure.

Other electrical tests regularly made for industry, in addition to those discussed, cover resistors ranging in value from 1 microhm to 100 megohms, inductors from 10 μh to 10 h, and capacitors from 0.01 $\mu\mu$f to 10 μf. Tests are made on standard magnetic specimens to determine normal induction and hystersis curves on direct current and also a-c permeability and core loss.

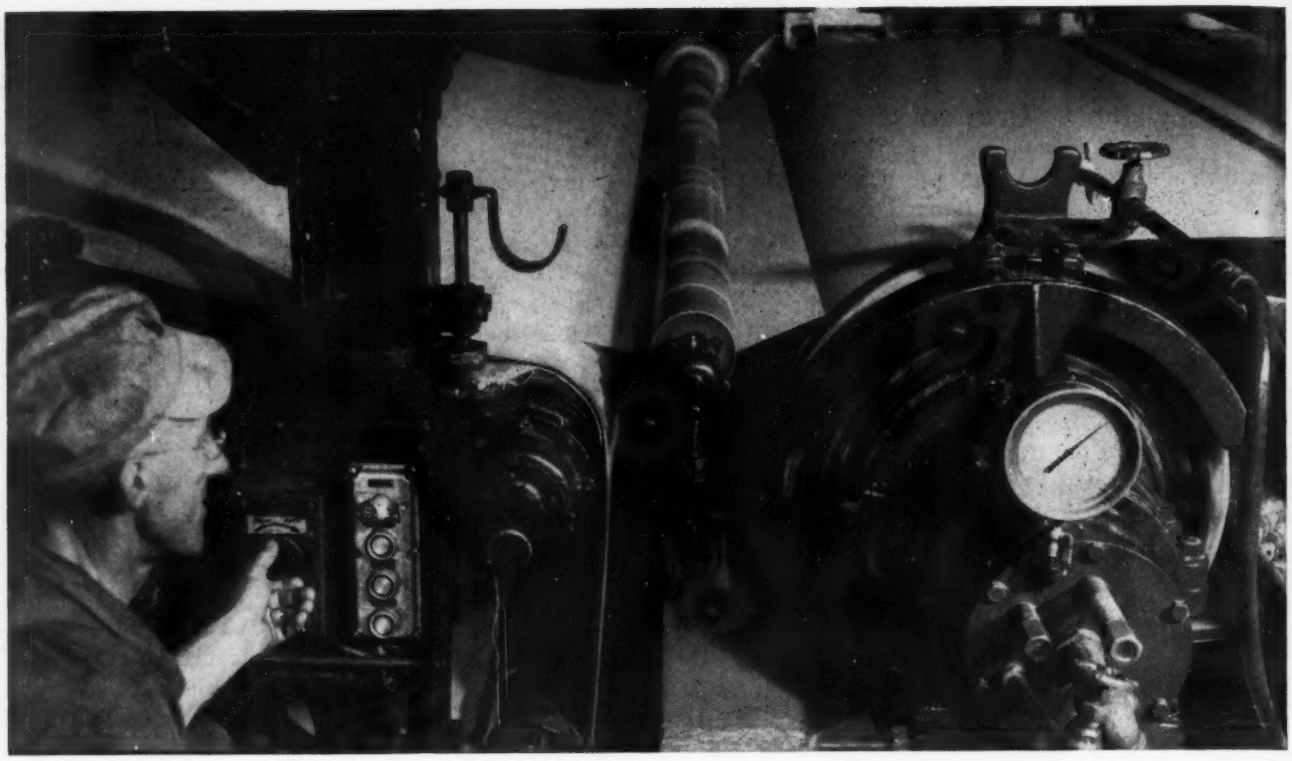
Routine Government Testing

The Bureau also does much routine electrical testing that is confined to agencies of the federal government, such as qualification tests of dry cells and of electric lamps and acceptance tests of insulating materials and devices. These insulation tests require neither great accuracy nor the dissemination of standard values.

By law the National Bureau of Standards is required to charge fees for tests other than those for branches of the state or federal governments. The fees pay the cost of the services rendered. Thus they are high enough to avoid subsidized competition with private testing laboratories, but are low enough to avoid penalizing any reasonable effort to obtain high accuracy. Copies of the fee schedules and instructions for specifying the desired tests, as well as details of shipment, can be obtained from the Bureau upon request.

The National Bureau of Standards is in no sense a repair shop. When any measuring instrument shows signs of trouble, it should be sent first to the manufacturer for repairs before being sent to the Bureau for test. If, as occassionally happens, some defect develops in the course of a test at the Bureau, the customer is billed for the testing which has been done prior to the discovery of the fault, as well as for the complete test when the instrument is later returned after it has been repaired by the manufacturer.

A growing feature of the electrical work of the Bureau is closer cooperation with technical committees of AIEE and other standardizing bodies working toward developing and standardizing methods for making tests and measurements.



ADJUSTING SPEED of a shunt motor to set the draw in the couch section of the West Virginia Pulp & Paper Co mill, Tyrone, Pa.

Applying Shunt Motors To Adjustable Speed Loads - I

For securing adjustable speed drives, usually the d-c shunt motor does the job better and for less cost than any other type of motor. Basic types of loads and motor relationships are discussed. A later article explains how motor characteristics are matched to load conditions

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SOME MACHINES require operation over wide range of speed; others need a closely regulated speed. With electrical speed control, relatively small changes in voltage and current easily control large changes in speed, torque, or horsepower of the drive motor. Generally, electrical speed control is more flexible, more easily adjusted, faster in response, and more suitable for complicated sequence operations and interlocking than any of the mechanical speed control methods. It is well adapted to automatic speed control and often provides a wider speed range than is otherwise possible. When d-c power is available, the d-c shunt motor fulfills the requirements more closely and economically for adjustable speed drives than do other types of motors.

Complete knowledge of the essential features of the driven machinery and the load characteristics is necessary for intelligent motor application. Except for a-c synchronous motor drives or drives with speed regulating controls, *the speed of most electrical drives is determined directly by the torque requirements of the load.* When the speed-torque requirements of a driven load are definitely known, the electrical drive performance can be predicted with reasonable accuracy. Where: T = speed, rpm; K = 5,520, a conversion constant; and hp = horsepower, then $T = \text{hp} \times K/N$ or $\text{hp} = T \times N/K$.

Electrical drives can be classified by the load requirements as: (1) constant torque, (2) constant horsepower, (3) combination of constant

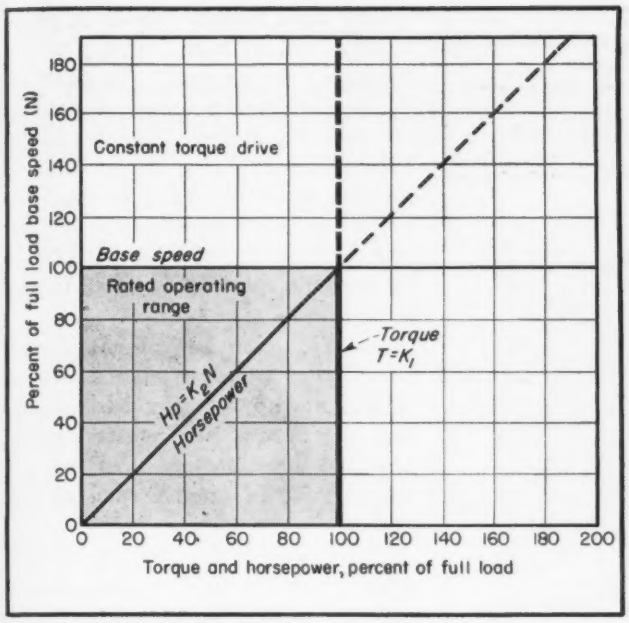


FIG 1—**CONSTANT TORQUE** characteristic in terms of speed

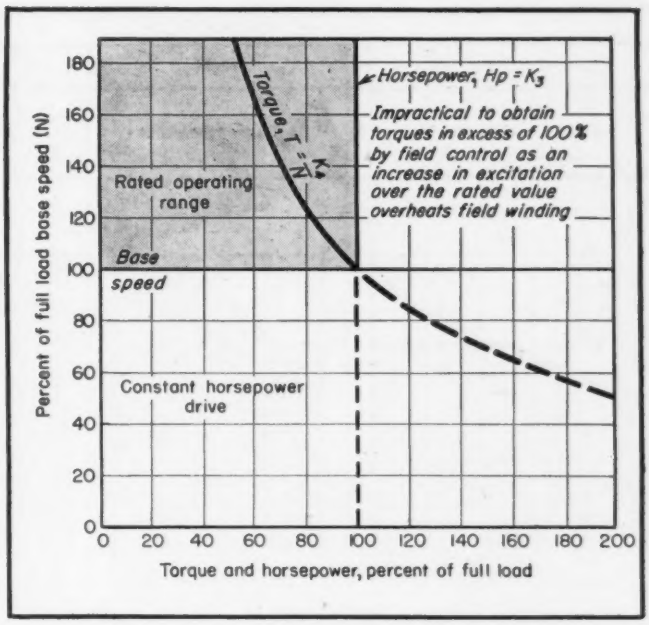

Horsepower, $Hp=K_3$
Impractical to obtain torques in excess of 100% by field control as an increase in excitation over the rated value overheats field winding
Torque, $T=\frac{K_4}{N}$
Rated operating range
Base speed
Constant horsepower drive
Percent of full load base speed (N)
Torque and horsepower, percent of full load

FIG 2—**CONSTANT HORSEPOWER** characteristic speed

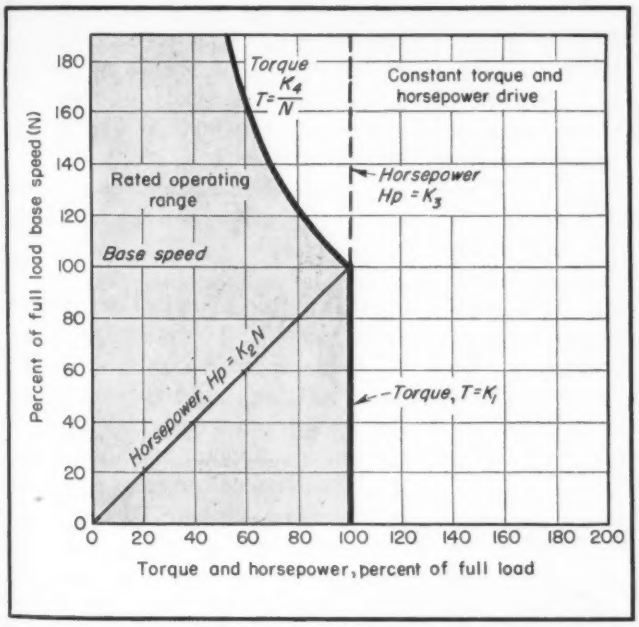


FIG 3—**CONSTANT TORQUE—CONSTANT HORSEPOWER**

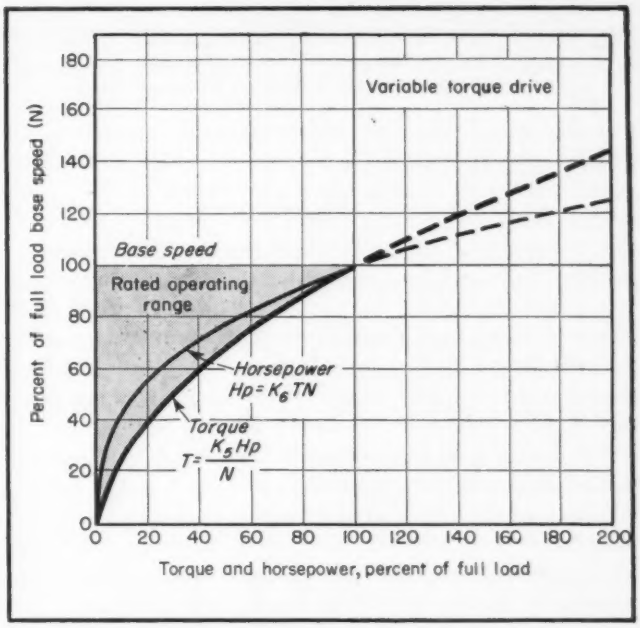


FIG 4—**VARIABLE TORQUE** characteristic in terms of speed

torque and constant horsepower and (4) variable torque.

Basic Types of Load

CONSTANT TORQUE. Compressors, chain grate stokers, belt conveyors, cranes and hoists, plunger pumps, and loading machines are typical constant torque loads, as shown in Fig 1. Total pull at any time is constant and independent of the speed. Horsepower varies directly as speed. Friction represents a constant torque load. In certain inefficient machines the predominating friction load causes the machine to have a constant torque characteristic regardless of the useful load characteristic.

CONSTANT HORSEPOWER. Machine tools, lathes, planers, drill presses, and machines with a controlled load are typical constant hp loads as shown in Fig 2. With a light load the machine can be operated relatively fast; for a heavy load, the machine should be operated slower. For example, as the cutting speed of a lathe is increased, the depth of cut is decreased to reduce the torque required for driving the load. Both the horsepower required and volume of metal removed per unit time is approximately constant over the entire speed range.

Similarly, constant horsepower is required for a core type paper winding machine. As the roll gets bigger, the driving motor must slow down to hold the sheet tension and linear paper speed constant.

CONSTANT TORQUE-CONSTANT HORSEPOWER. Loads requiring a wide speed range often use a combination constant torque and constant hp drive, as shown in Fig 3. This drive characteristic is typical of a d-c shunt

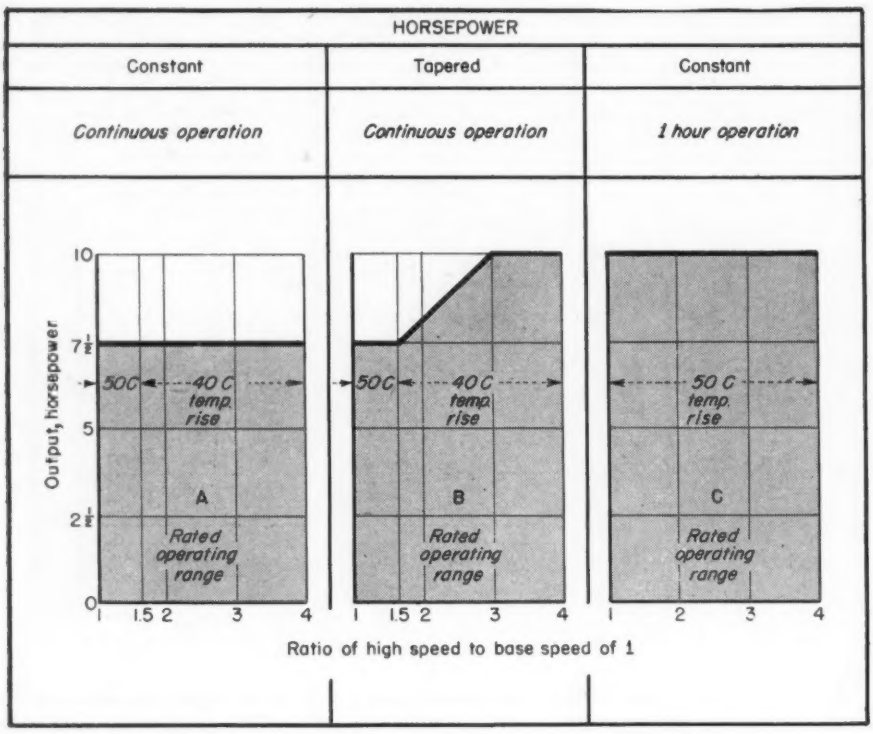


FIG 5—THREE BASES for rating a motor depending upon load requirements

motor that uses armature voltage control below the base speed for constant torque and field control above the base speed for constant hp characteristics. Typical applications include elevators and metal working planers.

VARIABLE TORQUE. Fans, blowers, and centrifugal pumps are typical variable torque loads since torque varies directly with speed as shown in Fig 4. Usually, the horsepower is considered to vary approximately as the square of the speed for a variable torque load.

Different numerical conversion constants K for the curves in Fig 1 to 4 are shown by subscripts.

The characteristics shown in Fig 1 to 4 are the safe maximum or boundary conditions for the driving motor. Seldom will the speed-torque characteristics of a single load exactly match those of the drive motor and control. But for a continuous duty rating, the load speed-torque requirements should not exceed those of the drive motor. Torque and hp output of the motor are related directly to the current the motor draws from the power supply. Therefore, the maximum torque or hp limitations must not be exceeded or the motor will overheat. Because a motor generally has considerable thermal capacity, intermittent overloads usually are not harmful. Applications such as cranes and hoists commonly use intermittently rated motors for economy.

At every speed, the available motor torque must be equal to or exceed that required by the load. The maximum torque and maximum speed of the load usually determines the hp rating of the motor to be used. This hp rating may be many times the value required to operate the machine at less than maximum speed.

Except when deviations in speed are practically excluded, such as in synchronous motors or by the use of automatic speed regulators, the speed is determined by the driven load. The motor always operates at a speed where its speed-torque characteristics are in equilibrium with the speed-torque requirements of the load.

Shunt Motors Widely Used

There are many applications where the use of d-c drive motors is absolutely necessary to meet the operating requirements. In general, an adjustable and wide speed range with precise speed control can be obtained only with d-c drives. Shunt wound motors are especially suitable for adjustable speed operation.

With constant armature voltage and fixed field current, "constant speed" shunt motors operate at practically constant speed regardless of variations in the load. In general, as the load varies from no-load to full-load, the change in motor speed is less than 12% for motors from 1 to 5 hp, and 10% for larger motors. For adjustable speed motors, regulation does not exceed 22% for 1 to 5-hp motors; nor 15% for larger motors.

Usually, constant speed, shunt wound, d-c motors are suitable over a speed range up to 2:1 by field control and for constant horsepower output, provided the top speed does not exceed the maximum safe rpm for the motor.

Shunt wound d-c motors with a speed range by field control of 3:1 or more are classed as adjustable speed motors. Standard 3:1 and 4:1 speed range motors can be applied when the top speed does not exceed the safe mechanical speed. Special motors with speed ranges up to 6:1 and 8:1 can be applied; but they cost more because of special field windings and frames.

A standard adjustable speed shunt wound d-c motor can be rated in three ways:

CONSTANT HORSEPOWER-CONTINUOUS OPERATION-40 C RISE. A given adjustable speed, shunt wound, d-c motor will have a 40 C temperature rise when continuously operated at constant hp output. It will develop the rated horsepower from 150% of the minimum or base speed to the maximum speed with 40 C temperature rise. From minimum speed to 150% of minimum speed, the motor can develop its rated horsepower. But its temperature rise may be as high as 50 C, which usually is considered within safe temperature limits.

TAPERED HORSEPOWER-CONTINUOUS OPERATION-40 C RISE. The same motor can have also a tapered hp rating. Because ventilation is much better at high than low speeds, a motor will develop the next higher hp rating at the higher speeds and still not exceed a 40 C rise. The motor can be operated continuously and it will develop the maximum horsepower at three times the base speed. The horsepower decreases in direct proportion to the decrease in speed, down to the specified hp rating at

150% of the base speed. For motors with a speed range of 4:1, the maximum rated horsepower is considered constant for speeds from three to four times the minimum.

CONSTANT HORSEPOWER-1 HR OPERATION-50 C RISE. The identical motor with a 1 hr rating will develop the next higher hp rating over the entire speed range with a 50 C rise.

These three ways of rating a given motor make it possible to apply an adjustable speed motor to a given application in the most economical manner. For instance, Fig 5 graphically compares the three ratings for a 7½-hp motor.

Even though a continuously rated motor for constant or tapered hp output is classified as having a 40 C temperature rise, it will usually have a 50 C rise from the base speed to 1.5 times the base speed because of reduced ventilation at lower speeds. On most adjustable speed applications, the motor is generally operated above 150% of the base speed. This is an economical method of rating a motor. A larger frame size is required for a motor that develops the rated horsepower from base to maximum speed without exceeding 40 C rise at the low speeds.

Speed Formulas

The counter emf generated by a motor opposes the line voltage. It is almost directly proportional to the motor speed. Where: E_A = counter emf; K = motor constant; ϕ = field flux; and N = speed, then $E_A = K \phi N$.

Also, where: I_A = armature current; V = line voltage; R_A = total armature circuit resistance, then $V = E_A + I_A R_A$; therefore, the basic speed equation for a d-c motor is $N = (V - I_A R_A)/K\phi$.

Since the product of the full load armature current I_A and the armature resistance R_A can be considered a constant, with constant field strength ϕ, the motor speed can be adjusted by changing the line voltage, as shown in Fig 6. Also, the equation shows that the $I_A R_A$ voltage drop must be relatively small in comparison to the impressed line voltage if the speed is to remain practically constant with changes in the armature current I_A. Generally, for shunt wound motors, this value $I_A R_A$ is approximately 10% of the line voltage.

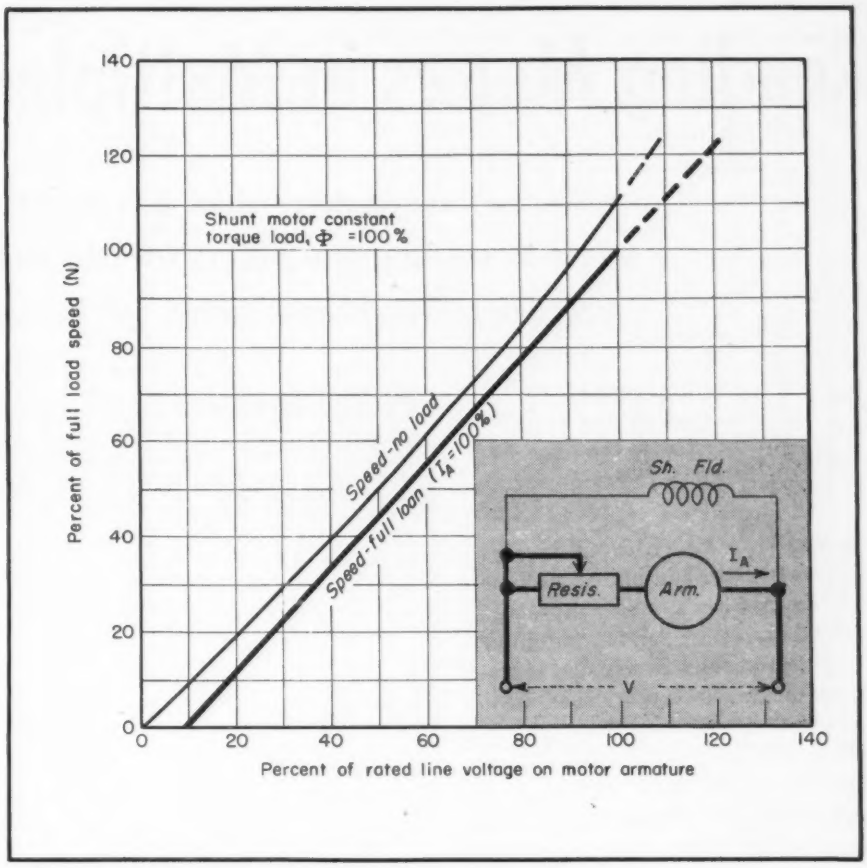


FIG 6—CHANGING VOLTAGE impressed changes speed of motor

Speed also can be changed by varying the shunt field strength. As shown in Fig 7, with constant line voltage V, the speed increases as the field becomes weaker. To obtain speeds below the base or full field speed, the voltage applied to the motor armature must be reduced.

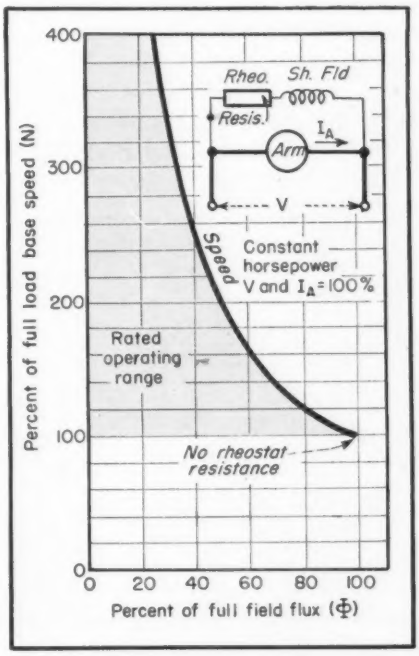


FIG 7 — CHANGING FIELD strength changes speed of motor

D-C Motor Basic Relationships

Torque T developed by a d-c shunt motor is proportional to the product of the field flux ϕ and the armature current I_A. Thus $T = K \phi I_A$. During starting and accelerating, most adjustable speed motor controllers provide full shunt field strength. This helps the motor to develop the required torque with minimum armature current. For constant field excitation, torque is almost directly proportional to the armature current. Motor torque can be controlled by changing the voltage applied to the armature, or by limiting the armature current by a series resistor.

Means of Speed Control

Different methods for controlling the speed of shunt d-c motors will be discussed in a later article. These include adjustment by changing armature resistance and various means of field excitation. Typical load applications will also be presented.

Reading Meters in Multiples of 10-KWHR

Company saves more than 3,000 man-hours per year in reading and billing on that basis. Believes practice merits consideration for industry practice

L. M. LA PORTE
Controller
Wisconsin Electric Power Co
Milwaukee, Wisconsin

READING METERS in multiples of 10 kwhr and billing customers on that basis, eventually may be standard practice for the public utility industry. This conclusion is based upon the results experienced in our company in the last three years in which this practice has been in use. In that period, it is estimated that more than 3,000 hours a year are saved in performing the meter reading and billing operations on about 284,000 accounts.

Before adopting this procedure, however, the company made a thorough study of its past meter practices. During the 1920's, in accordance with practices generally followed by public utilities in reading meters, our company, too, read its meters to the exact number of kilowatt-hours recorded on the registers. It was recognized at that time, however, that an appreciable saving could be realized in meter reading and office clerical work if reading and consumptions were shown only in even units. Studies were made along these lines, and in 1930 arrangements were made to read meters to the nearest even kilowatt-hour unit.

In 1943, it was decided to estimate consumptions for average bills issued (when regular readings were not obtained) in multiples of ten, instead of in even units. This practice was followed only for consumptions in excess of 50 kwhr per month, because it was felt that some of the customers whose monthly consumption was small might object to the variation between actual consumption and the estimated consumption. This practice was followed for over two years and did not result in any adverse criticism by customers.

WISCONSIN ELECTRIC POWER CO.

LAST DISCOUNT DATE — JUN 28 1948
FOR PERIOD ENDED — JUN 7 1948

JUN 28 48 29
JUN 7 48 12

*	METER READINGS PRESENT	METER READINGS PREVIOUS	KILOWATT HOURS USED	AMOUNT GROSS	AMOUNT NET	*	AMOUNT GROSS	AMOUNT NET	MOS.
	1960	1860	100	3.23	2.98 RS		3 23	2.98	
	6700	6350	350	2.38	2.25 WH		2 38	2.25	
					5.23 TOTAL $		ACCOUNT NUMBER 2450	5.23 TOTAL	

*CODE

AV	Average Bill	MIN	Minimum Bill
BR	B. C. C. R. Service	MS	Miscellaneous
CM	Commercial	RE	Repairs
CR	Credit	RS	Residential
IN	Installment	RU	Rural
MD	Merchandise	WH	Water Heating

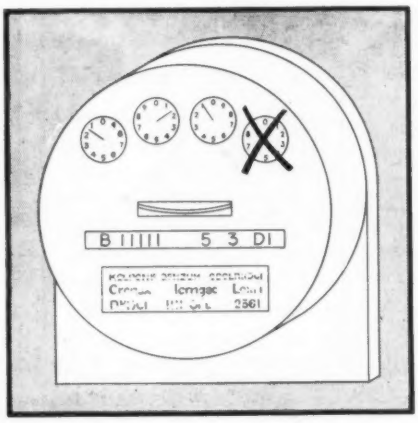
Check over this bill
I think you'll agree,
For the work I do,
It's a very small fee.

1700 2450 M01
JOHN J DOE
3032 N 42 ST
MILWAUKEE 10 WIS
P 444 WF

When Paying by Mail Return This Coupon
WISCONSIN ELECTRIC POWER CO.

TYPICAL BILL still contains all four digits in present and previous meter readings and kilowatt-hours used columns, but units digits are always zero

Early in 1945, we began studying the advisability of reading meters in multiples of five or ten kwhr instead of even multiples. Preliminary studies showed that reading in tens would result in considerably larger savings than reading in fives, particularly in the billing operations which are performed on International Business Machine equipment. Also, these studies showed that it would not be practicable to apply the practice only to consumptions in excess of some given amount, as was being done for average bills. Such a practice would make it necessary for the meter reader to read the meter and make the subtraction, before he could determine whether the consumption and meter reading would be in multiples of ten or in multiples of two. Also, office procedures would not be simplified because it would still be necessary to handle some accounts with consumptions ending in even numbers—two, four, six or eight.



IF ADOPTED as standard practice by the industry, meter manufacturers could eliminate the units dial on the meter

Effect of the proposed meter reading practices on electric service bills was considered and was found to be negligible, and in the month of May, 1945, arrangements were made to read meters in multiples of 10 kwhr. This practice applies only to meters with constants of one; readings and differences for meters with constants of more than one are still recorded to the exact number shown on the

register. This is done because of the greater kwhr variations which would result when the differences are multiplied by the constants.

In September, 1945, the last phase of the reading in tens program was adopted. This consisted of discontinuing the entry of the last digit—units digit—of the reading and consumption on meter sheets for meters with constants of one. These digits are always zeros and therefore can be omitted. The adoption of this practice has not in any way affected the information shown on the customer's bill. Readings and differences are still shown in their entirety on the billing records and on the bills. This means that no change in bill design was necessary. A sample of the Wisconsin Electric Power Company's bill is illustrated.

In adopting the reading in tens procedure, it was possible to modify many procedures so that meter reading and billing operations can be performed more economically, resulting in the following annual savings:

1. *Reading Meters* Easier reading, easier subtracting, fewer figures to be written. The full effect on meter reading is pictorially displayed by eliminating one dial.	1,890 hr
2. *Figuring Bills* Smaller-size rate tables, fewer units of consumption for figuring, fewer accounts to be figured manually.	440 hr
3. *Keypunching Billing Cards* Three less holes to be punched manually for each card, fewer cards to have billing information punched manually.	630 hr
4. *Checking Subtractions* Fewer subtraction errors to be corrected, fewer units of consumption for figuring bills for corrected consumptions.	60 hr
5. *Sorting Billing Cards* One less sort when sorting cards by consumptions, fewer master cards to be sorted.	320 hr
6. *Master Extending Billing Cards* Fewer master cards for master-extending (Gross savings of 36 hr partially offset because more detail cards are master extended)	30 hr
Total estimated annual savings	3,370 hr

In addition to the savings estimated above, savings were also realized on the following operations:

a. Recording initial readings
b. Recording final readings
c. Recording meter change readings
d. Reading postal card markings
e. Recording postal card readings
f. Transcribing data for use by other groups

These operations affect a much smaller number of accounts than those included in items 1 to 6 above, and accordingly, no individual estimates of savings were made. It appears, however, that the additional estimated savings are about 260 hr per year.

The practice of reading and billing in units of ten has been accepted favorably by our customers. At the time of the installation of the practice and during the three years in which it has been in effect, no unfavorable comments have been received.

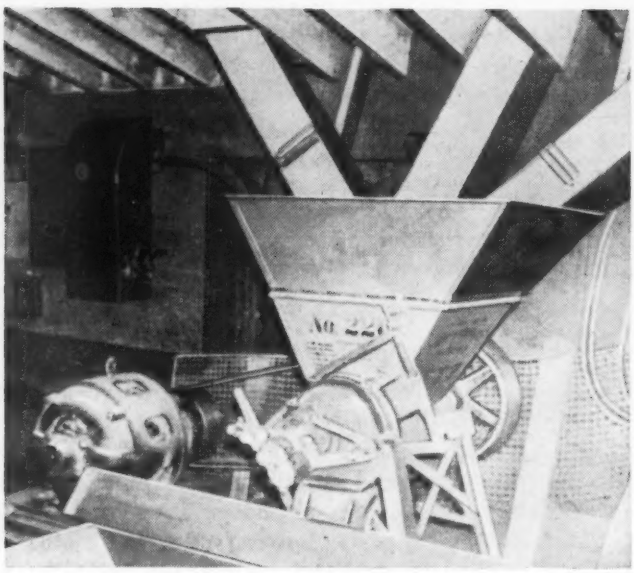
Electricity Trains Cows To Keep Barn Clean

APPLICATION of electricity to keep dairy barns clean is currently being studied at Wisconsin Utility Association's electrical experimental farm. Although the project is still new, early results have been promising.

Many installations of barn cleaners have been made but the criticism most often heard is that too much chore time is used in scraping manure from the stall floor into the trough. At the Wisconsin experimental farm an answer to the problem may be found.

Cow trainers have been installed just above the shoulders of each animal. These trainers are made of iron wire and are connected to a 6-v wire fence circuit which runs along the ceiling. Should the cow be standing too far forward in the stall and hump, she will receive a shock from the trainer. When this happens she immediately moves back nearer the trough. The cows soon learn that there is a proper position in the stall and so the stall floor remains clean.

COW TRAINER (circled) connected to electric fence circuit (arrow) keeps stall floors clean. A. J. Von Burg, Wisconsin Power & Light Co's rural sales manager, explains this to A. F. Herwig, Wisconsin Utility Association executive secretary



PLATE, OR SO-CALLED BURR-MILL, feed grinder (left) will operate at any speed. The lower the speed the lower the power requirement . . . 450 tons of turkey feed are ground per year by this 8-in hammer mill (right) driven by a 10-hp motor

Farm Power Supply—Essentially A Job For Single Phase

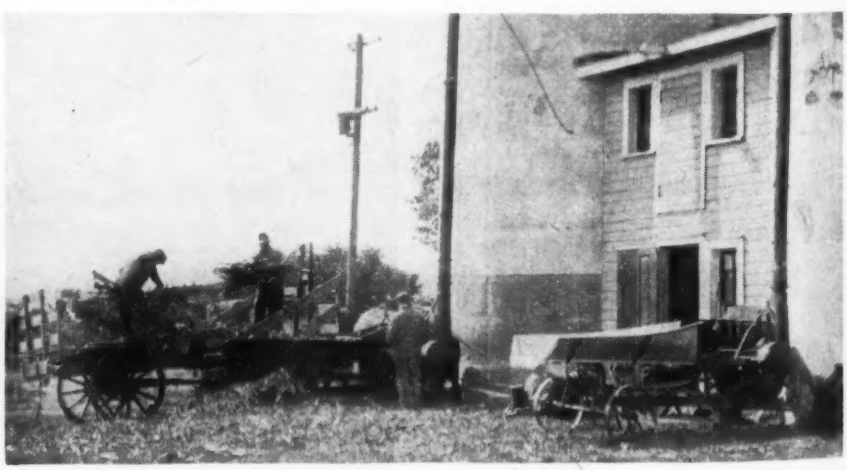
Demands for 3-phase supply come from farmers who have not been convincingly shown what single-phase will do for them at less cost. Responsibility for showing them lies with the suppliers of service

C. H. GELDER
Manager, Dakota County Electric Cooperative
Farmington, Minnesota

DEMANDS OF FARMERS for 3-phase services are simply the restatement of a service difficulty that was old before the first farm was connected to an electric line. The time and the place and the words are different, but the trouble is the same.

Over-motoring has been a widely prevalent problem in industrial plant drives from the very beginning of electric service. It is being cured only slowly. There still remains a strong disposition among users to say, "Well, the job figures out to show that a 5-hp motor is enough, but let's use a 10; then we'll be sure." That feeling has cost industry many millions of dollars in wasted electricity and has put suppliers of electric service to a tremendous amount of unnecessary trouble and expense caused by low power factor and excessive voltage drop.

The same problem now arises in rural service as farmers make more uses of electric power. It manifests itself sometimes, in strong demands for 3-phase service. The farmers say they are hampered by the limitation on motor size imposed by single-phase supply. They want to use bigger motors. They are following the



MOTOR SIZE ARGUMENTS are not new. Back in 1929, University of Minnesota engineers tested motor performance on ensilage cutters. They found out then that the lowest speed that would elevate the ensilage was the most economical in motor and electricity cost. Cutters with 11-in to 19-in throats were tested. All were operated successfully with motors of 3 to 10 hp

same line of thought as the shop foreman who says, "Let's put on a 10 and be sure." And they are just as wrong.

Except for those farms so big and so specialized that they should be thought of as factories instead of farms, single-phase supply is entirely adequate. If farmers will take time to learn that work performed is a function of power and time, and that speed is purchased often at a heavy cost in power, then they will conclude they don't need 3-phase service nearly as much as they thought.

Even for Threshing

The farm job with the largest power requirement is threshing. But a 21-in. to 23-in. threshing machine can be driven by 3 motors, a 10-hp, a 3, and a 1½ or 2. Several threshing machines driven by motors of 3 to 7½ hp are available.

Another job apparently calling for a substantial amount of power is feed grinding, especially if the heavier hammer mill grinder is used. These machines are available in three general types—the plain mill, a running-feed table mill, or a mill with a running-feed table and butters ahead of the hammers. Power to perform the work is reduced considerably in the apparently more complicated machines. These special machines are small and of high speed and can be purchased with attachments for ear corn crushing or chopping before the feed enters the grinding chamber.

The capacities of the small machines are high per horsepower. Their original purchase price, cost of the motor and of wiring for motors of large capacity will not justify the use of large motors excepting on a very small percentage of the farms. The energy required for grinding grain on the farm is small. It may vary from 8 to 12 kwhr per year per cow. Thus, at the most on a 20-cow dairy farm we can expect about 240 kwhr per year for grain grinding. This is less than one-half hour per week on a 10-hp motor, one hour per week on a 5-hp or five hours per week on a 1-hp.

Filling the silo is one of our major jobs on the farmstead. It is an outside job and can be performed either by the use of a tractor or an electric motor of preferably 7½ hp. For satisfactory operation the cutter should operate at the lowest speed that will elevate into the silo. With good cutters of the proper size, two men can unload silage from the wagon with a 7½-hp motor drive, operating at a speed to blow into a 45-foot silo. Larger motors are uneconomical because of the high speed required. Theoretically, the cutting capacity can be doubled by doubling the speed. But when we double the speed of an ensilage cutter we increase its power requirement seven times.

Husking and shredding has practically disappeared from our Minnesota farms but where it survives it can be handled by a 7½-hp motor.

Minnesota farms usually have large barns, the hay season is short, and a considerable amount of air is needed for mow curing. As fan size increases the quantity of air to be handled per horsepower is much greater with larger fans than with smaller ones. Ten-hp motors can be equipped with fans of reasonable cost to deliver more than 40,000 cubic feet of air per min. This capacity will serve a barn 34 to 36 feet wide and 70 to 80 feet long. The air speed and duct size can be reasonable in this case. But when air is increased beyond 40,000 cfm, its flow will develop increased resistance in a reasonable size duct system or else the ducts will have to be made disproportionally large for the barn. The power requirement per ton of hay will increase materially. This load is, therefore, well within the capacity of single-phase motors.

Large Hay-Curing Job

A somewhat larger than usual installation of hay drying equipment was installed during the past season on a farm served by the Waseca-Steele Cooperative in Minnesota. In addition to the hay drying equipment, this farm also uses considerable other electrical equipment such as barn cleaner, milker, water heaters, electric range and various small motors, consuming from 500 to 1,000 kwhr per month. A 10-hp motor was used for the drier equipment. A single-phase line serving this farm proved to be adequate and entirely satisfactory. Consumption was approximately 4,000 kwhr during the hay drying season.

Many studies and field tests have shown that the farm electric motor can be kept within reasonable size and that single-phase service is adequate. There are, of course, exceptions. In these cases the added cost of supplying 3-phase service and the necessary higher rates to meet this cost must be considered. It will then invariably be found that the competition of the gasoline engine does not justify the additional supply system cost for the extension.

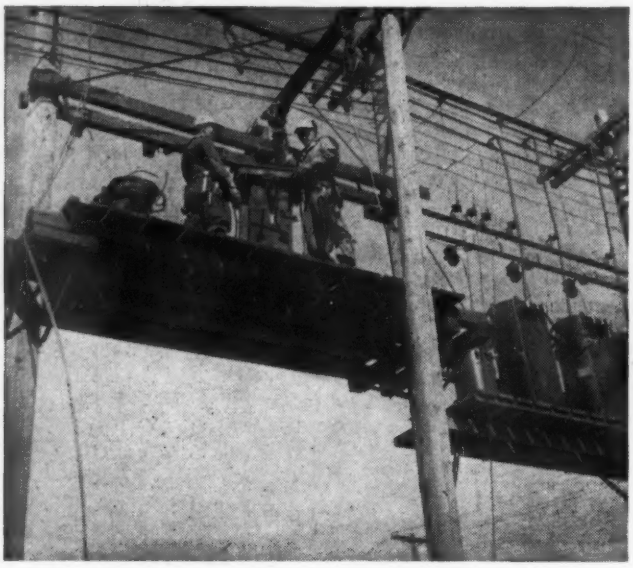
Most of the demand for 3-phase service comes from farmers who have given little or no consideration to the additional cost for wiring and other changes necessary before this service can be used. True, the price of a 3-phase motor is about half that of the same size single-phase but this saving is more than offset by other costs.

Low Load Factor

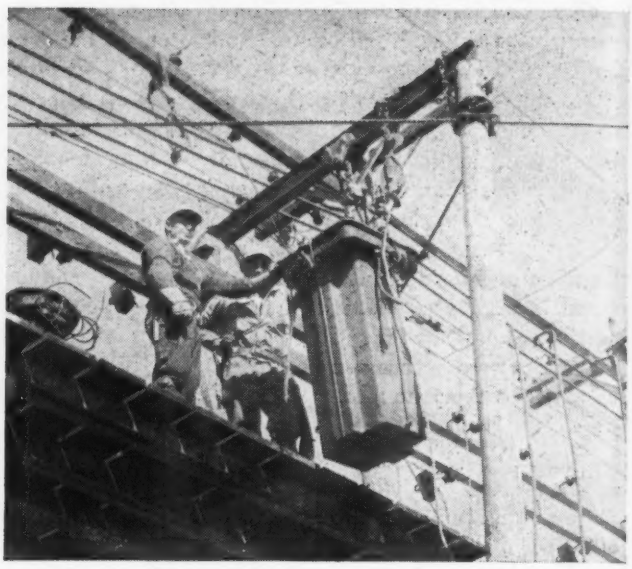
The most conclusive argument against the use of 3-phase service for farms is the fact that it is used only a comparatively small part of the time and thus must result in an extremely low load factor. In addition, the farms which might use or require 3-phase service are entirely too scattered and few in number. It is my contention that the additional cost to offer unlimited service to a limited number of customers must be borne by those particular customers.

Since farm electric service is essentially single phase in character, it seems obvious that we, as power suppliers, should know how to solve the farmer's power problems within the operating capacity of single-phase motors, not larger than 10-hp. Our lines should be constructed to carry that power. The customer must not object to an occasional flicker of lighting due to starting currents of these motors. The farmer must also be told how to equip his feed mills with small motors to avoid overloading and how to protect the motor against overloading. If the power supplier and the dealer do a good job of selecting equipment and advising the farmer, single phase will be adequate.

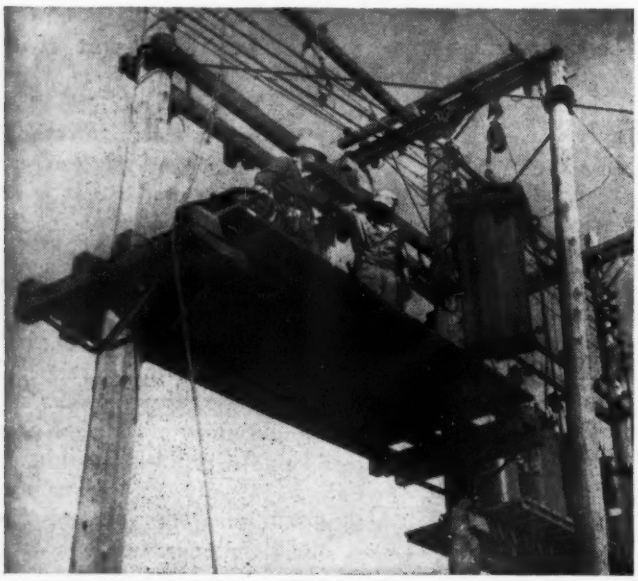
When the time comes that 3-phase service is economically feasible for the farm, if it ever does, the electricity supplier will pull up the small poles, add the additional conductors, install larger transformers and change the meters. Until that time the American farmer should use the equipment that is now available and which can be driven by motors within the capacity of single-phase lines.



1 TRANSFORMER IS RAISED from platform by a lever operated hand hoist trolley that rides along I-beam



2 TRANSFORMER IS MOVED away from platform by I-beam trolley into position for transfer to block and tackle



3 TRANSFORMER IS TRANSFERRED from trolley to fall line and stationary block in preparation for lowering to the ground

4 TRANSFORMER IS LOWERED to ground by truck or winch. In general, the method shown has proved quick and safe

Extra Pole Simplifies Moving Transformers

JOSEPH E. YOUNG
Superintendent
Public Service Department
Moorhead, Minn

LARGE TRANSFORMERS can be raised or lowered to platforms quickly and safely by using the following equipment and procedure.

The equipment consists of a steel or aluminum 4 in. x 8 ft I-beam, an I-beam trolley, a lever hand hoist, two snatch blocks, and rope for guying a light pole.

The procedure is: Set and guy a temporary pole about 3 ft from the edge of the platform. Install the 4-in. I-beam in a horizontal position with one end resting on the top or lashed to the side of the pole and the other end resting on the struts above the platform. Position of the beam may be changed according to the location of the transformers being moved. A temporary brace is set under the struts to the heavier beams below. Steps in the actual moving are shown in the picture sequence.

Although it takes a little more time to set the extra pole, the safety and certainty achieved provides an overall saving in time and is much safer than many other methods used.

What's new in GE street lighting

New Relay

for series mercury circuits cuts transformer requirements 45%

Here is a most important development in mercury street lighting—the new Half-load Relay which solves the problem of starting mercury-vapor lamps on series circuits in cold weather. This relay eliminates the necessity of providing, for cold weather starting, approximately twice the constant-current-transformer capacity required for warm weather.

RELAY OPERATES WITH CONTROLLER TO SHORT OUT HALF THE CIRCUIT

The relay accomplishes this cut in transformer requirements by starting only half of the lamps first, and then after they are burning, starting the second half. Relay operates in conjunction with a standard street-lighting controller with normally open contacts—connected across the series loop at about the half-way point

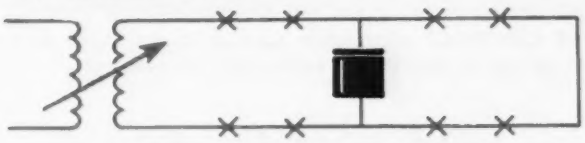
THIS IS THE WAY IT WORKS

A few seconds after the series circuit is energized, the relay operates the controller, shorting out the second half of the circuit. With the reduced load, the lamps in the first half start, and the voltage across them drops to normal. The relay then opens the controller, and the remaining lamps start. The circuit is so arranged that the standard protector will detect an open in either half of the load loop.

CUTS DOWN TRANSFORMER COSTS

With the Half-load Relay, only warm-weather allowances need be figured for cold-weather starting—830 watts for the EH-1 and 625 watts for the CH-5 mercury lamps. Except in minimum-size installations, this means a saving in transformer costs.

Mr. J. Peterson, General Electric design engineer, examines the new Half-load Relay for outdoor pole mounting.



New relay and standard controller are connected across series mercury loop at about mid-point, to short circuit the far half of loop during starting.

GENERAL ELECTRIC

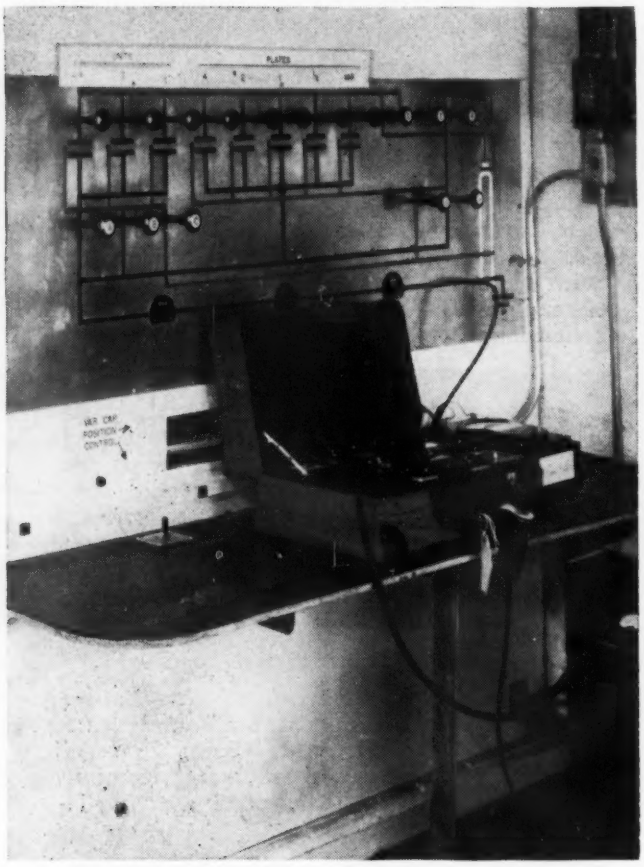
452-73

GOOD STREET LIGHTING BUILDS GOOD WILL

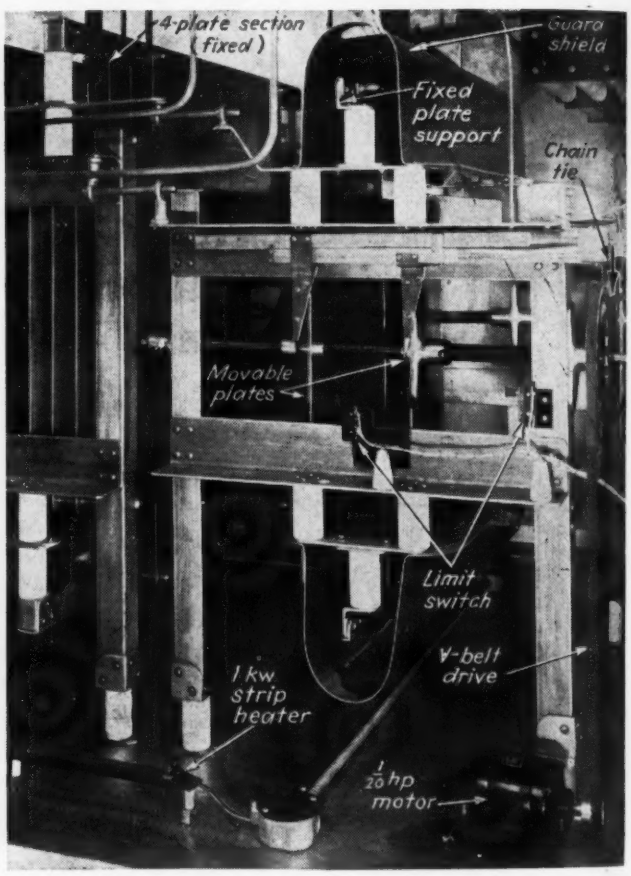
The new Half-load Relay is another of General Electric's developments that help you provide better street lighting at lower cost. For additional information call your Apparatus Office or write *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

Are you tying in with the NEMA plan to give America better street lighting?

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



SIMPLE CONTROLS select values between 50 and 25,000 mmf in high voltage air capacitor for calibrating test equipment



SURFACE LEAKAGE is reduced by four electric heaters maintaining the interior temperature about 10 C above ambient

Variable Air Capacitor Calibrates Test Equipment

H. E. POVEY
Development Engineer
Doble Engineering Co
Belmont, Mass.

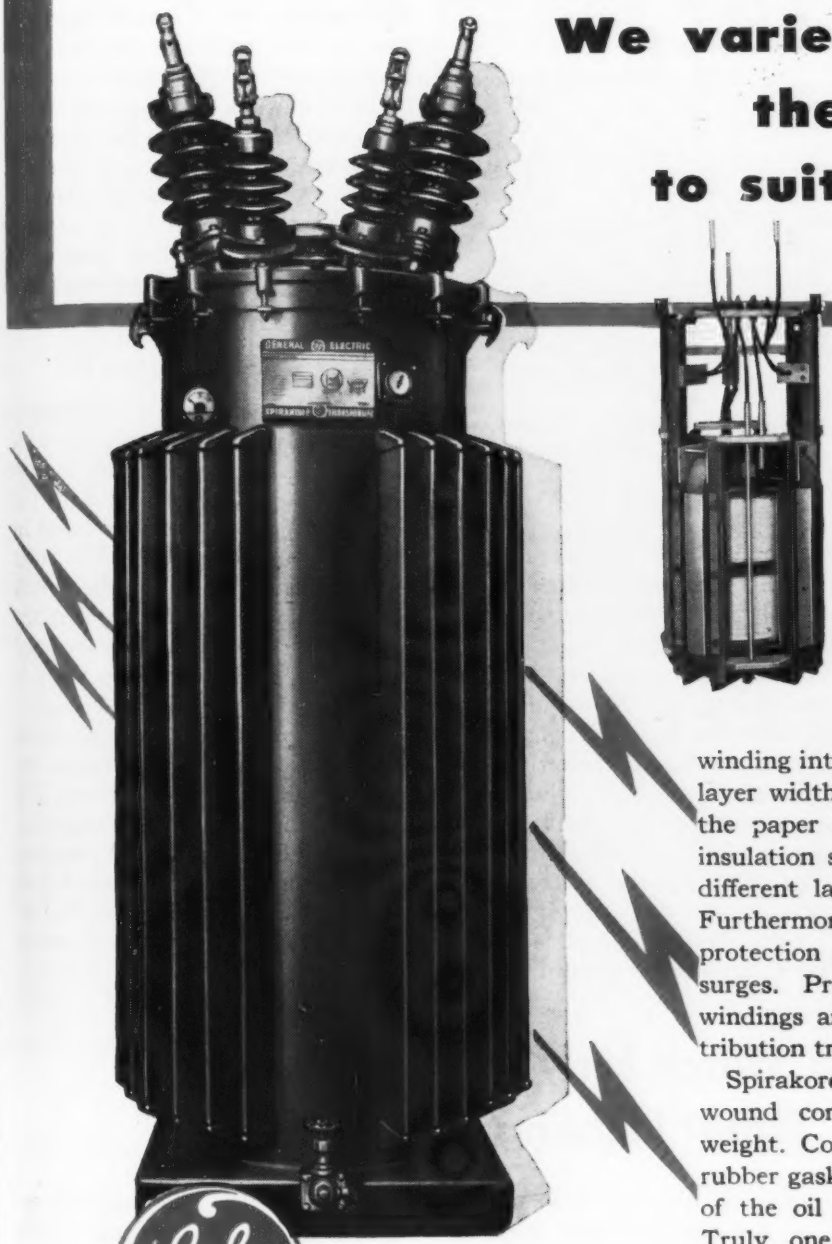
A HIGH-VOLTAGE air capacitor with a range of 50 to 25,000 mmf has been developed by the Doble Engineering Co, Belmont, Mass., for use in calibrating its insulation testing equipment. It is designed to have no appreciable losses. By switching fixed-capacitance units and by adjusting a variable unit any capacitance in the above range may be obtained. The capacitor is normally used at 10 kv and has no audible corona below 15 kv(rms).

The capacitor plates are of aluminum, a material chosen after consultation with the Bureau of Standards. They are 2 ft x 3 ft, spaced $\frac{3}{4}$ in. apart. Eight high-voltage and nine low-voltage plates are assembled to form a standard unit, of which there are seven. The eighth unit is special in that its high-voltage plates are subdivided in groups of 4, 2, 1, and $\frac{1}{2}$. The variable unit consists of one fixed high-voltage plate and two low-voltage plates, one on each side of the fixed plate. The low-voltage plates may be moved toward or away from the fixed plate by rotating threaded rods on which they are mounted. All metal parts are carefully designed to avoid sharp corners and edges.

The high-voltage plates are supported from the low-voltage plates by two sets of insulators, separated by a metallic strap that serves as a guard electrode. For the lower capacitance ranges the guard electrode may be used at either high or low potential. For the higher capacitance ranges,

To foil lightning

We varied the strength to suit the stress!

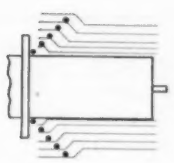


To give you distribution transformers with greatly increased impulse strength, we took our cue from the approved textbook principle: "Provide the greatest strength where the stress is greatest." From this principle, we developed our unique design of progressive-layer insulation and shielded winding.

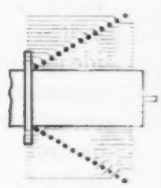
This design compensates for the difference in layer-to-layer voltage stress, from one end to the other, by winding into the coil along with the conductor, a full-layer width of paper dielectric. As turns are added, the paper layers increase in number—keeping the insulation strength, between any two conductors in different layers, proportional to the voltage stress. Furthermore, the entire coil is shielded—giving added protection against the damaging effects of impulse surges. Progressive-layer insulation and shielded windings are a feature of all G-E Spirakore® distribution transformers above 15,000 volts.

Spirakore design—with flux following the spirally wound core steel—affords great savings in total weight. Complete sealing of the tank, with Nitrile rubber gaskets, maintains the high dielectric strength of the oil and prolongs the life of the insulation. Truly one of the finest distribution transformers we've ever made. Ask for Bulletin GEA-4521. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

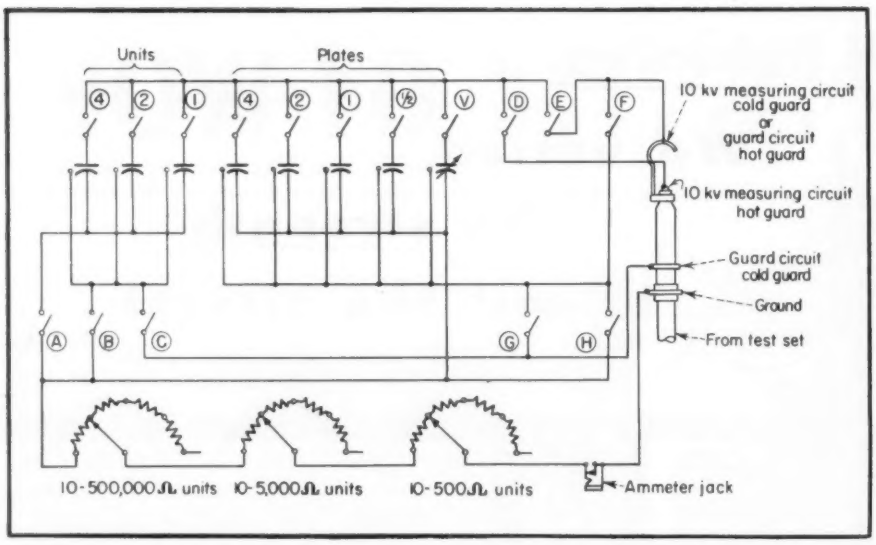
Spirakore Transformers



Cross section shows how, as turns are added, the paper insulation is wound into the coil along with the conductor.



GENERAL ELECTRIC



COMBINATIONS of fixed-capacitance units and adjustment of variable unit give 500 to 1 range in 10 kv capacitor

the guard electrode is designed to be used at low potential only. For many tests a guard is not used and the guard electrode is then connected to the low-voltage plates.

Aluminum Panels Used

The entire bank is housed within an angle-iron framework, 6 ft x 9 ft x 10 ft. Side, roof and floor panels are of sheet aluminum. The temperature inside the housing is maintained at about 10 C above ambient by thermostatically controlled electric heaters. Four 250-w heating units were required. It has been found that this temperature differential will practically eliminate surface leakage difficulties.

To facilitate capacitance adjustments a switching unit was designed with all controls terminating on a front panel. As in power station switchboard practice, the circuit diagram of the capacitor bank appears on the panel. The switch controls are located in their proper places on the diagram so that the operator can tell at a glance how the circuit is set up. A panel indicator is provided to show the position of the variable unit, operated by a 1/20-hp motor.

The Doble company, which has specialized for the past 20 years in the determination of insulation condition by the watts-loss power-factor method, utilizes the capacitor bank in several ways. Perhaps the most important of these is in the checking of insulation test sets for internal losses. A test set can be checked throughout its entire capacitance range and any departure from zero loss readings recorded and used as a basis for a correction curve or chart.

Impedance Standard

Another application of the capacitor bank is in conjunction with a variable series resistor as a low-power-factor impedance standard for the calibration of wattmeters used in insulation measurements. A current meter is placed directly in the circuit with the series resistor, so that the loss in the resistor may be calculated by the I^2R formula. Since there is no appreciable loss in the capacitor bank, the resistance loss represents the entire loss in the impedance. By using several values of current (by changing the setting of the capacitor bank) and by using several values of series resistor, a sufficient number of known losses may be established to calibrate the wattmeter over its entire range.

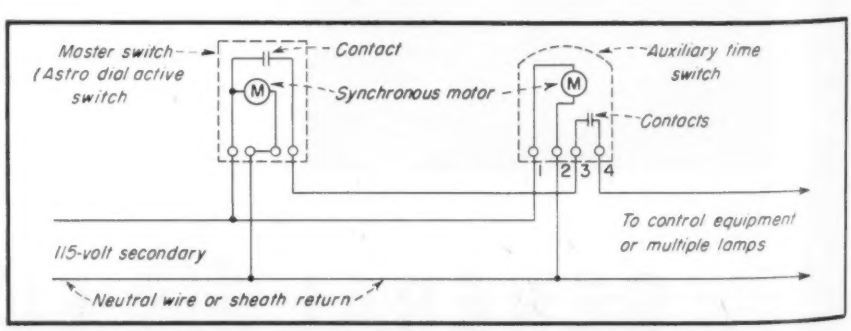
How to Switch Early Morning Street Lighting

EARLY MORNING street lighting is required for the benefit of factory workers' shift changes in some areas outside of the city proper. Boston Edison Co has provided for time switch control of such service by using a master and an auxiliary switch connected as shown. The basic idea is to install a time switch with separate motor connection as a supplement to the existing master switch. To set the two switches for early morning burning the procedure is as follows:

Master Switch: Set the switch riders to "turn on" and "turn off," as for standard all-night burning.

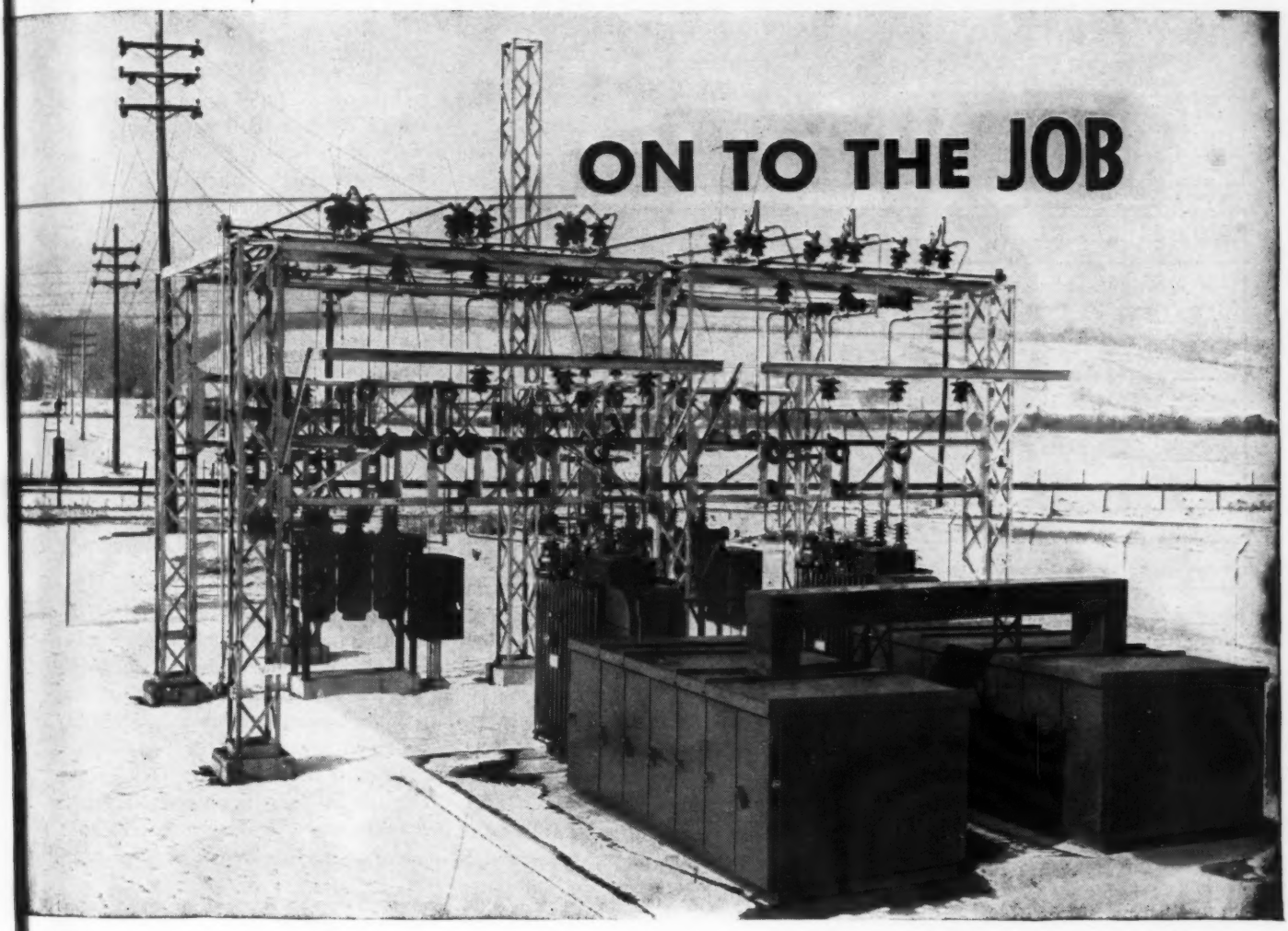
Auxiliary Switch: Set the "off" rider to the ordered part-night "cut-off" time. Set the "on" rider to "cut on" at the required early morning "on" time.

Seasonal Discontinuance: At the end of the early morning burning period, re-set the master switch "off" rider to "cut off" at the ordered part-night "cut-off." Jumper the switch terminals marked 3 and 4 of the auxiliary switch. No other changes are necessary to discontinue early morning burning.



AUTOMATIC starting and stopping of early morning street lighting service

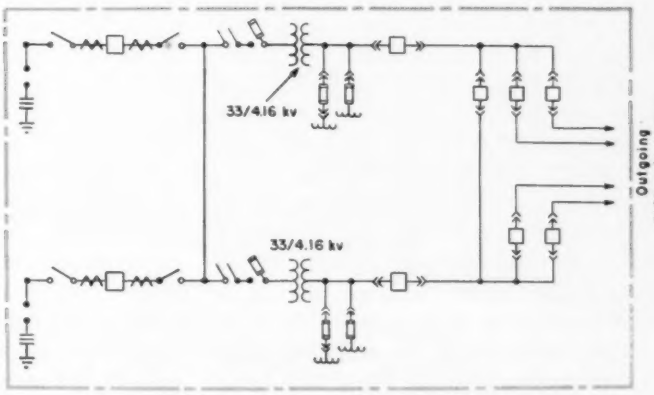
Substation . . .



VE TIME AND MONEY WITH THE *UNIT APPROACH*
GET THE COMPLETE SUBSTATION AS A *UNIT.*

Thirty of the basic package substation arrangements e shown in GEA-4500 (left, above). Use it to investi- te the *unit approach* to your next substation applica- n. We think you'll be pleasantly surprised. Your G-E es representative will gladly provide a copy and p you all he can. *Apparatus Dept., General Electric mpany, Schenectady 5, N. Y.*

PACKAGE SUBSTATION



GENERAL ELECTRIC

POLE RECORD

POLE _____ LINE POLE

LOCATION _____

SIZE _____ POLE ERECTED _____ BY _____ WORK ORDER _____

BUTT TREATMENT _____ DATE _____

MATERIAL _____	FUSE BOXES _____	GUY WIRES _____	TRANSFORMERS _____
CROSS ARMS _____	BRACKETS _____	LIGHT'G ARR. _____	NO. _____ K.W. _____
PINS _____	NO. WIRES _____	PIPE CONN. _____	NO. _____ K.W. _____
POLE STEPS _____	SIZE WIRE _____	BRACES _____	NO. _____ K.W. _____

MISCELLANEOUS _____

EXAMINED	PAINTED	BY	CONDITION

J. O. ORIGINATION

BY _____ REQ _____ DATE _____ TO _____ FOR _____

BY _____ REQ. _____ DATE _____ TO _____ FOR _____

BILLING DATA

$ _____ TO _____ BILL NO _____ DATE _____ FOR _____

$ _____ TO _____ BILL NO _____ DATE _____ FOR _____

$ _____ TO _____ BILL NO _____ DATE _____ FOR _____

$ _____ TO _____ BILL NO _____ DATE _____ FOR _____

CONTRACT _____ DATE _____ PLAN _____ BLOCK _____ POLE _____

FOREIGN ATTACHMENTS _____ DATE _____

POLE RECORD CARD, 6½ in. x 8 in., is employed for line poles, with color changes for private street lighting poles, and privately owned poles. Lower section carries information as to joint ownership participation

Scheduling Pole and Line Inspection—I*

SYSTEMATIC scheduled inspection of poles and lines on an eastern utility of between 50,000 and 75,000 customers leaves little to be overlooked. A joint line representative is responsible for proper periodic inspection and minor repairs, reports and records. Aerial cables are excepted. This work is done in the field by the company's line inspector with the aid of one first-class lineman. Each year this inspector is required to make one complete inspection of the entire overhead distribution system. Metal street lamp poles are also inspected.

Every wooden pole owned entirely or in part by the company, as long as it remains in service, is inspected at the ground line at the end of the first five years of its life. This is done at least once every half decade thereafter for the purpose of estimating the probable life of the pole.

Annually between Jan. 1 and March 1 a technical assistant in the engineering department examines all the pole record cards and prepares pole record slips for the year's butt inspection as follows:

Each pole record card is examined and a blue metal clip attached to the upper left portion of all cards corresponding to poles which at the time of their last inspection were estimated to be good for 5 years or less. Also included are new poles due for their first inspection or poles which are due for inspection under the above 5-year limit. In case the previous year's inspection was not completed a yellow clip is used for the second year, so that these poles are inspected first. These temporary clips (blue and yellow) are placed so as not to interfere with other clips of a more permanent nature, and can be removed only after inspection when posting the results of the inspection on the pole record card.

Poles condemned by the inspector have a red clip immediately placed on the corresponding pole record card about 1.5 in. from the upper right-hand corner. Such clips are removed only when the pole is replaced. Poles located in hazardous areas have permanent pink clips attached to the record cards 2.5 in. from the upper right-hand corner. These poles normally have preferred attention. Jointly owned poles in locations maintained by the Bell telephone company in the utility's territory have a V-shaped notch punched in the top of each pole record card 2 in. from the right-hand corner.

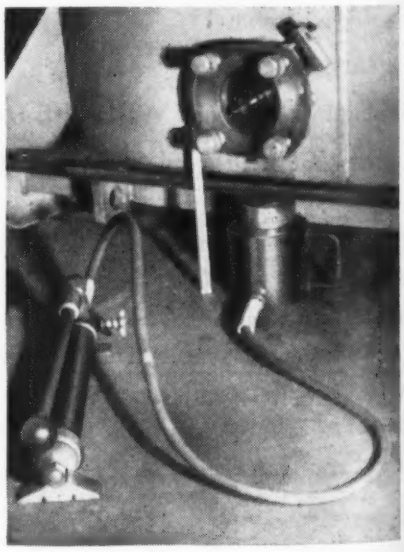
The inspector fills out a pole record slip for each pole record card marked with a clip. This slip is copied from the pole record card and gives the number and location of the pole, date of its last inspection and estimated life at that time.

* Beginning a series of five articles.

Jack Lifts Loads With Small Clearance

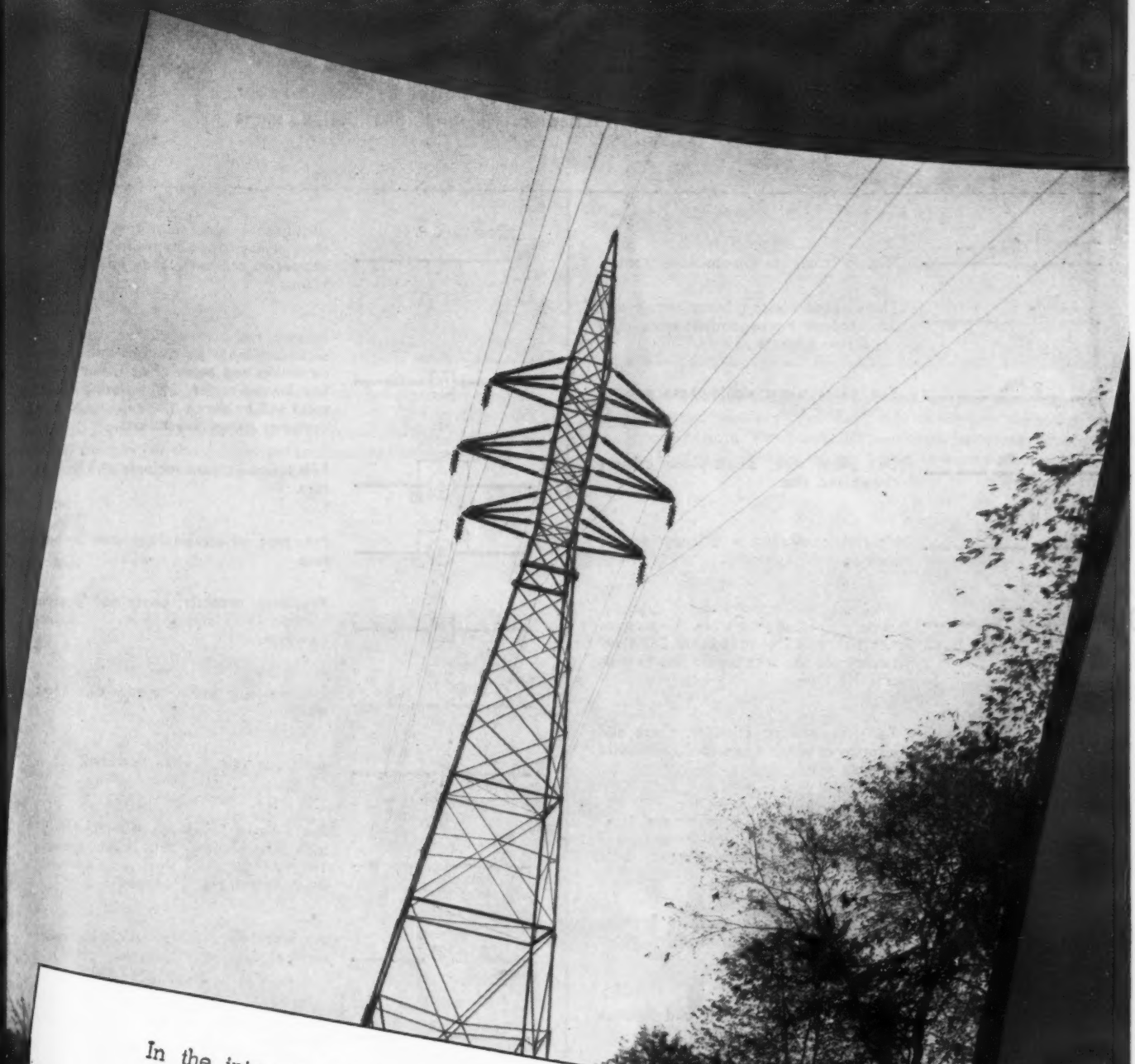
LIFTING heavy equipment which has little clearance for placing hydraulic jacks has long been a problem. Bonneville Power Aministration has built in its shops the hydraulic jack shown especially for lifting transformers on flat-car beds.

Overall height of the jack, which can lift 50 tons, is only 5½ in. It is operated by a hydraulic hand pump, and extends to a height of 9 in.



HYDRAULIC JACK built by Bonneville Power Administration shops for lifting loads with small clearance. It requires only 5½-in. clearance, can lift 50 tons to full extension of 9 in. from base

Line for 7 Years within 9 percent
OF ESTIMATED LIGHTNING PERFORMANCE



In the interests of technical progress of high-voltage transmission, this series of operating reports is presented to the Electrical Industry. As a manufacturer of insulators and hardware, the Ohio Brass Company is vitally concerned in this development. These reports and many others have been compiled in book form, and are now available to power company engineers on request.

2858H

Ohio Brass

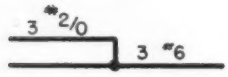
MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ontario

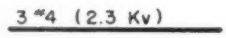
Symbols Developed for Distribution Maps

I—Primary Circuits

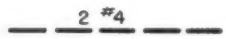
Series of symbols listed here have been standardized by Georgia Power Co for use on both construction prints and distribution maps



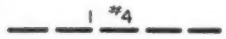
Primary trunk feeder to load center.



Three phase wires; primary circuit and size. Indicate voltage where more than one system appears on map.

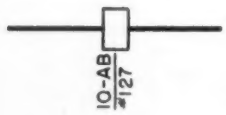


Two phase wires; single-phase primary circuit and size.



One phase wire; single-phase primary circuit and size.

Neutral conductor in primary neutral position (not common).

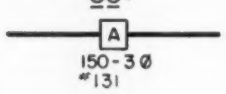


Single-phase transformer; capacity, phase and location number. Underscore size with solid line to indicate CSP type. Underscore size with broken line to indicate HB type.

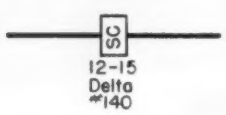
Two transformers; capacity, phase and location number. Connected open delta or open wye.

Three transformers; capacity and location number. Consider delta-connected secondary unless otherwise noted.

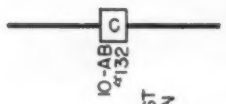
Two transformers, 3 phase to 2 phase or 2 phase to 3 phase; capacity, phase and location number.



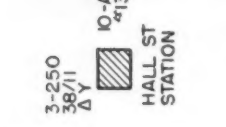
Autotransformer; capacity and location number.



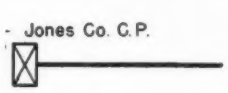
Shunt capacitors; number of units, capacity of each unit, connection (delta or wye) and location number.



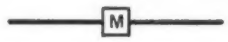
Constant current transformer; capacity, phase and location number. Note: All transformers other than company owned shall be marked C.P. (customer property).



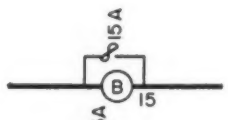
Company owned substation.



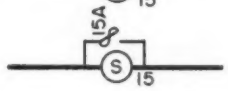
Customer owned substation. (Do not show equipment or transformer size if in substation account). Show name of customers.



Primary metering equipment (show on secondary maps for location only). Show ownership and name of customer owned line beyond meter. No metering equipment will be shown where in company or customer owned substations.

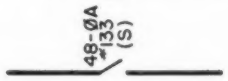


Pole type oil circuit recloser with by-pass fuse.

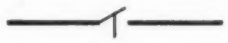


Pole type oil sectionalizer with by-pass fuse.

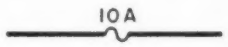
Regulator; capacity; phase and location number. (S = step type or I = induction type).



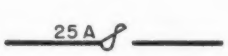
Single - pole knife - blade disconnect switch.



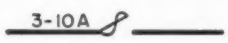
Air break switch, gang operated.



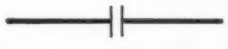
Fused cutout (expulsion or dropout type) with size of fuse link shown. Where strapped out show wire size, example: 8c indicates No. 8 copper wire.



Air break disconnect switch with fusible element (generally gang operated).

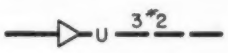


Repeating fuse, number of shots and fuse size.

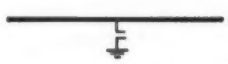


Break in phase wires.

Sectionalizing point with hot line clamps.

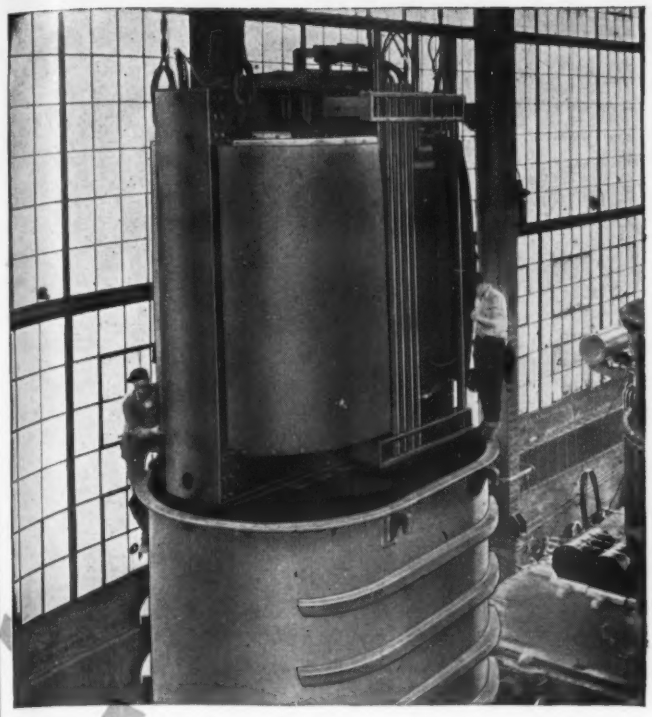


Pothead and underground line.

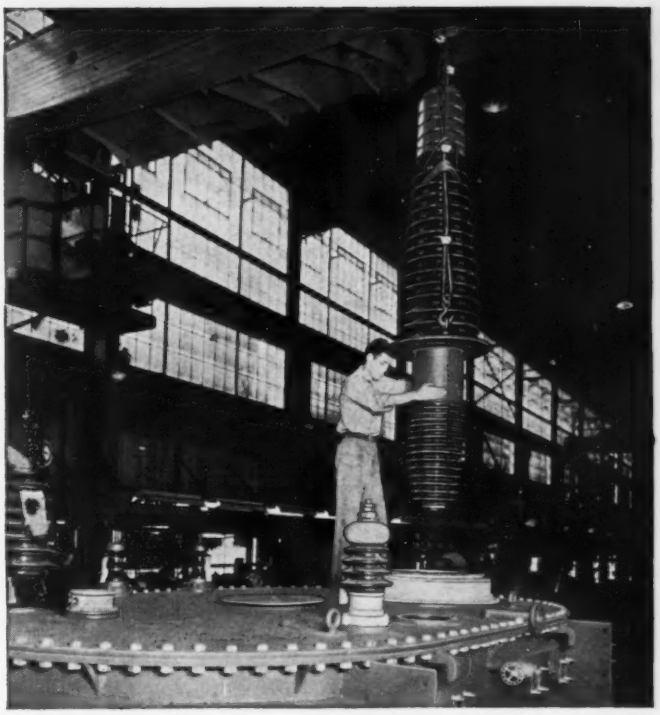


Isolated lightning arrester.

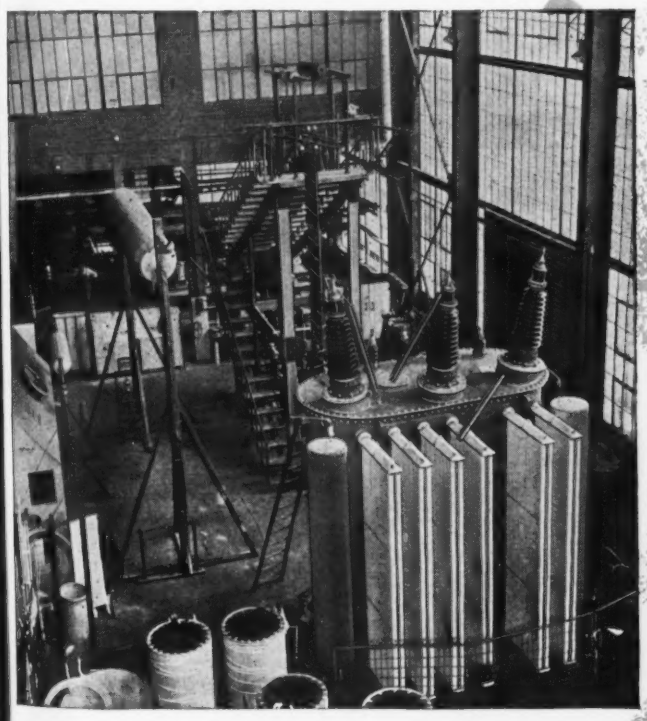
Adapted from a paper "Distribution Mapping" by W. F. Poole, Distribution Engineer, Georgia Power Co. Atlanta, Ga., before Southeastern Electric Exchange at Tampa, Florida. This article is first in a three-part serial.



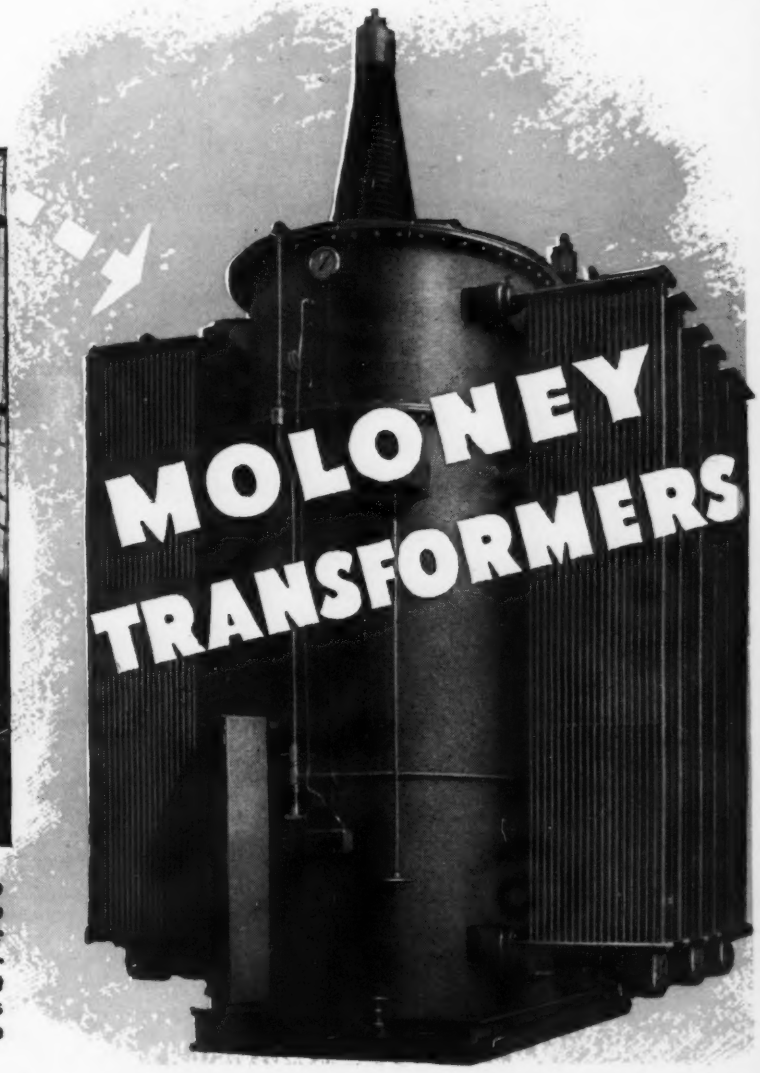
Following drying in a vacuum tank, the core-and-coil assembly is placed in its own tank, under oil. Channel guides provided on the inside of the tank to facilitate this operation, make it simple for the purchaser to remove the core-and-coil assembly for inspection, if desired.



After the core-and-coil assembly has been tanked and anchored securely in place, the tank cover is bolted or welded into position. The bushings are then installed. Photo shows a 115 Kv oil-filled bushing being lowered into position.



Frequently, purchasers specify that their transformers be impulse tested. This test is performed in the Moloney Surge Laboratory located at one end of the Power Transformer Assembly Department. Impulse tests, especially steep front-of-wave tests, simulate lightning conditions and are the most severe that can be imposed upon a transformer. The results of these tests are recorded on film by means of a cathode ray oscillograph.



Aluminum and Copperweld-Copper Cable Data

Weight, breaking strength and d-c resistance is listed for both types of conductors . . . Tables are an adaptation from advance pages for forthcoming 8th edition of Standard Handbook for Electrical Engineers

ALUMINUM CABLE

(Compiled from tables published by Aluminum Co. of America)

Conductor size		Hard-drawn copper equivalent,* Mcm or Awg.	Conductor stranding		Conductor diameter, in.	Conductor area, sq. in.	Conductor weight, lb		Breaking strength, ultimate, lb	D-c resistance at 25 C (77 F),† 61 % conductivity, ohms per mile
Awg	Cir mil		No. of wires	Wire diameter, in.			Per 1000 ft	Per mile		
...	1,590,000	1000	61	0.1615	1.454	1.249	1492	7878	30,000	0.0587
...	1,510,500	950	61	0.1574	1.417	1.186	1418	7484	28,500	0.0618
...	1,431,000	900	61	0.1532	1.379	1.124	1343	7091	27,000	0.0652
...	1,351,500	850	61	0.1489	1.340	1.062	1268	6696	26,000	0.0691
...	1,272,000	800	61	0.1444	1.300	0.9990	1194	6302	24,500	0.0734
...	1,192,500	750	61	0.1398	1.258	0.9366	1119	5908	23,400	0.0783
...	1,113,000	700	61	0.1351	1.216	0.8741	1044	5514	21,850	0.0839
...	1,033,500	650	37	0.1672	1.170	0.8117	970	5121	19,480	0.0903
...	954,000	600	37	0.1606	1.124	0.7493	895	4726	17,980	0.0979
...	874,500	550	37	0.1538	1.077	0.6868	821	4333	16,480	0.107
...	795,000	500	37	0.1466	1.026	0.6244	746	3939	15,300	0.117
...	750,000	472	37	0.1424	0.997	0.5890	704	3716	14,400	0.124
...	715,500	450	37	0.1391	0.974	0.5620	671	3545	14,050	0.131
...	636,000	400	37	0.1311	0.918	0.4995	597	3151	12,490	0.147
...	556,500	350	19	0.1711	0.856	0.4371	522	2757	10,490	0.168
...	500,000	314.5	19	0.1623	0.812	0.3927	469	2477	9,425	0.187
...	477,000	300	19	0.1585	0.793	0.3746	447.6	2363	8,990	0.196
...	397,500	250	19	0.1447	0.724	0.3122	373.0	1969	7,650	0.235
...	336,400	4/0	19	0.1331	0.666	0.2642	315.7	1667	6,605	0.278
...	300,000	188.8	19	0.1257	0.629	0.2356	281.5	1486	5,890	0.311
...	266,800	3/0	7	0.1953	0.586	0.2095	249.1	1315	5,030	0.350
4/0	211,600	2/0	7	0.1739	0.522	0.1662	197.6	1043	3,990	0.441
3/0	167,806	1/0	7	0.1548	0.464	0.1318	156.7	827	3,160	0.556
2/0	133,077	1	7	0.1379	0.414	0.1045	124.3	656	2,610	0.702
1/0	105,535	2	7	0.1228	0.368	0.0829	98.5	520	2,070	0.885
1	83,693	3	7	0.1094	0.328	0.0657	78.1	412	1,710	1.12
2	66,371	4	7	0.0974	0.292	0.0521	62.0	327	1,405	1.41
3	52,635	5	7	0.0867	0.260	0.0413	49.0	260	1,135	1.78
4	41,741	6	7	0.0772	0.232	0.0328	39.0	206	918	2.24

* Area of hard-drawn copper cable (conductivity = 97 % IACS) having the same resistance as that of the aluminum cable (conductivity = 61 % IACS).
† Increased 2 % to allow for stranding.

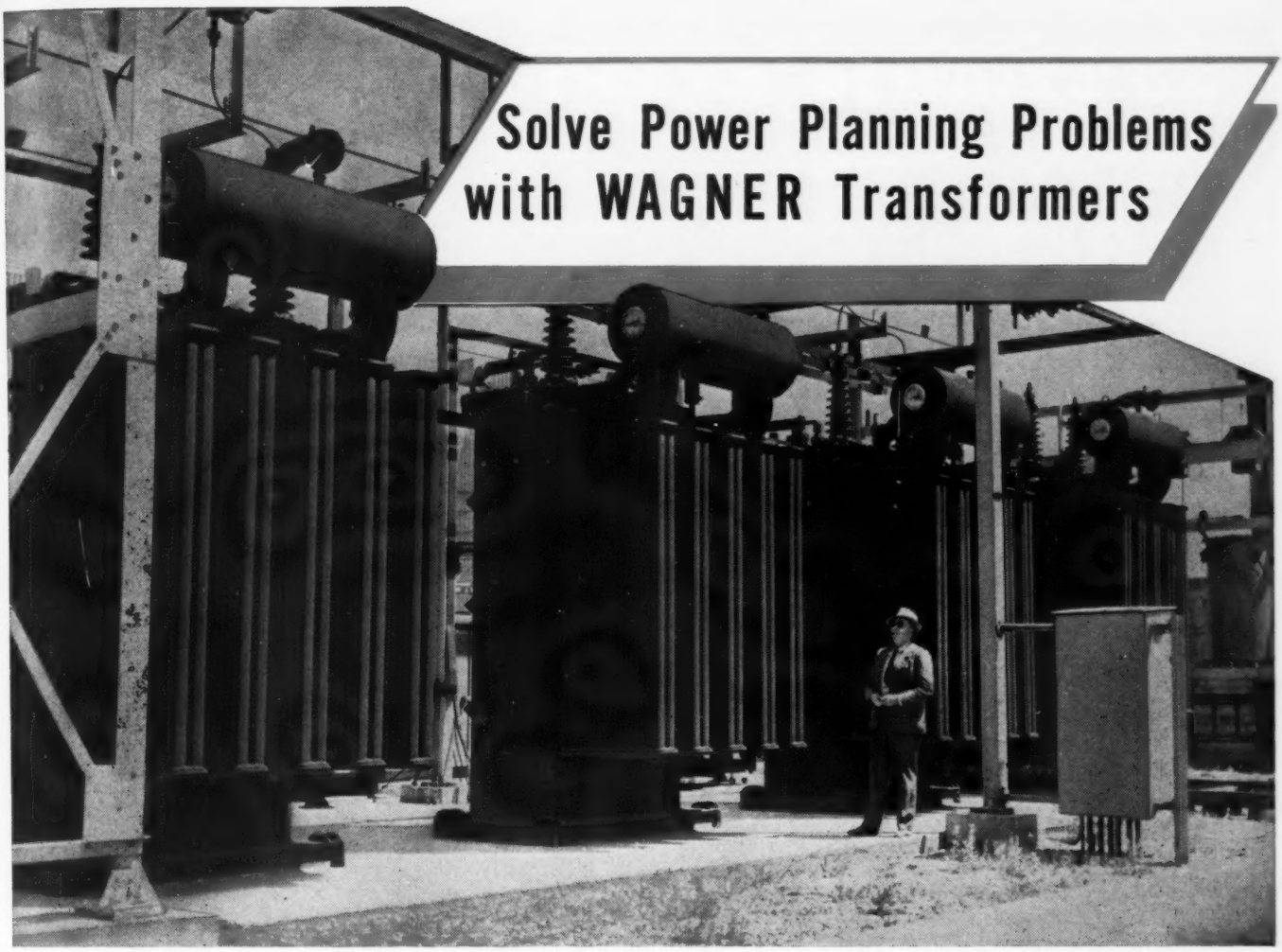
COPPERWELD-COPPER CABLE

(Compiled from tables published by Copperweld Steel Co.)

Hard-drawn copper equivalent,* Mcm or Awg	Conductor type	Conductor stranding: EHS 30 % Copperweld wires, No.	EHS 30 % Copperweld wires, Diameter, in.	Hard-drawn copper wires, No.	Hard-drawn copper wires, Diameter, in.	Conductor diameter, in.	Conductor area, sq in.	Conductor weight, lb: Per 1000 ft	Conductor weight, lb: Per mile	Breaking strength, minimum, lb	D-c resistance at 20 C (68 F), ohms per 1000 ft
350	E	7	0.1576	12	0.1576	0.788	0.3704	1403	7409	32,420	0.03143
350‡	EK	4	0.1470	15	0.1470	0.735	0.3224	1238	6536	23,850	0.03143
350	V	3	0.1751	9	0.1893	0.754	0.3254	1246	6578	23,480	0.03143
300	E	7	0.1459	12	0.1459	0.729	0.3175	1203	6351	27,770	0.03667
300	EK	4	0.1361	15	0.1361	0.680	0.2763	1061	5602	20,960	0.03667
300	V	3	0.1621	9	0.1752	0.698	0.2790	1068	5639	20,730	0.03667
250	E	7	0.1332	12	0.1332	0.666	0.2646	1002	5292	23,920	0.04400
250	EK	4	0.1242	15	0.1242	0.621	0.2303	884.2	4669	17,840	0.04400
250	V	3	0.1480	9	0.1600	0.637	0.2325	889.9	4699	17,420	0.04400
4/0	E	7	0.1225	12	0.1225	0.613	0.2239	848.3	4479	20,730	0.05199
4/0	EK	4	0.1143	15	0.1143	0.571	0.1949	748.4	3951	15,370	0.05199
4/0	V	3	0.1361	9	0.1472	0.586	0.1968	753.2	3977	15,000	0.05199
4/0	F	1	0.1833	6	0.1833	0.550	0.1847	710.2	3750	12,290	0.05199
3/0	E	7	0.1091	12	0.1091	0.545	0.1776	672.7	3552	16,800	0.06556
3/0	EK	4	0.1018	15	0.1018	0.509	0.1546	593.5	3134	12,370	0.06556
3/0	V	3	0.1212	9	0.1311	0.522	0.1560	597.3	3154	12,220	0.06556
3/0	F	1	0.1632	6	0.1632	0.490	0.1464	563.2	2974	9,980	0.06556
2/0	J	3	0.1648	4	0.1648	0.494	0.1493	560.6	2960	13,430	0.08265
2/0	G	2	0.1542	5	0.1542	0.463	0.1307	496.6	2622	10,510	0.08265
2/0	V	3	0.1080	9	0.1167	0.465	0.1238	473.8	2502	9,840	0.08265
2/0	F	1	0.1454	6	0.1454	0.436	0.1162	446.8	2359	8,094	0.08265
1/0	J	3	0.1467	4	0.1467	0.440	0.1184	444.3	2346	10,970	0.1043
1/0	G	2	0.1373	5	0.1373	0.412	0.1036	393.6	2078	8,563	0.1043
1/0	F	1	0.1294	6	0.1294	0.388	0.09207	354.1	1870	6,536	0.1043
1	K	4	0.1412	3	0.1412	0.423	0.1096	406.2	2144	11,900	0.1315
1	J	3	0.1307	4	0.1307	0.392	0.09390	352.5	1861	9,000	0.1315
1	G	2	0.1222	5	0.1222	0.367	0.08216	312.2	1649	6,956	0.1315
1	F	1	0.1153	6	0.1153	0.346	0.07303	280.9	1483	5,266	0.1315
2	J	3	0.1164	4	0.1164	0.349	0.07447	279.5	1476	7,322	0.1658
2†	A	1	0.1699	2	0.1699	0.366	0.06799	256.8	1356	5,876	0.1658
2	F	1	0.1026	6	0.1026	0.308	0.05792	222.8	1176	4,233	0.1658
3	J	3	0.1036	4	0.1036	0.311	0.05906	221.7	1171	5,955	0.2090
3†	A	1	0.1513	2	0.1513	0.326	0.05392	203.6	1075	4,810	0.2090
4	D	2	0.1615	1	0.1615	0.348	0.06147	225.5	1191	7,340	0.2636
4†	A	1	0.1347	2	0.1347	0.290	0.04276	161.5	852.8	3,938	0.2636

Conductor types

* Area of hard-drawn copper cable having the same resistance as that of the composite cable.
† Sizes commonly used for rural distribution.
‡ High-strength Copperweld, 40 % conductivity.



Solve Power Planning Problems with WAGNER Transformers

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This bank of power transformers, installed in a large aircraft plant in the Southwest, is typical of Wagner transformer installations for industrial power systems.

Wagner Power Transformers have established enviable records for continuous service in thousands of industrial plants and on transmission lines from coast to coast. Carefully controlled production methods, highest quality materials, rigid inspection and tests, and more than fifty-five years of transformer engineering experience mean that you can count on Wagner Transformers for dependable performance, plus added safety . . . added economy . . . and added service.

Users of power transformers will find it to their advantage to consult Wagner engineers on all of their transformer requirements. Wagner transformer users also profit by speedy, nationwide service facilities. Twenty-nine branch offices, manned by trained field engineers, are ready to serve you. Write for Bulletins TU-180 and TU-181 for information on the complete line of Wagner Transformers.

In addition to power transformers, Wagner can furnish Rural-Line, Distribution and Substation Transformers—all sizes and types.

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ELECTRICAL AND AUTOMOTIVE PRODUCTS

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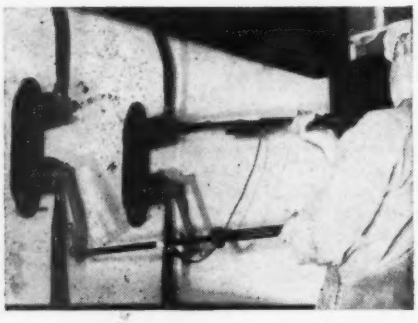
Utility Designs Own Hi-Pot Tester



TESTING PHASE-TO-PHASE voltages with auxiliary phasing stick. Each stick has ten megohms of high voltage industrial resistors. The connecting cord puts them in series with the indicating instrument, a rectifier type milliammeter

D. L. BROWN
Testing Department
Portland General Electric Co
Portland, Oregon

A QUICK, easy and dependable method of measuring voltages up to 10,000 v phase to ground has been developed by Portland General Electric. With an auxiliary phasing stick phase-to-phase voltages up to 20,000 v may be measured.

Essential elements of the testing device are ten megohms of high voltage industrial type resistors, a 1 ma rectifier-type milliammeter, and a grounding cord, all in series.

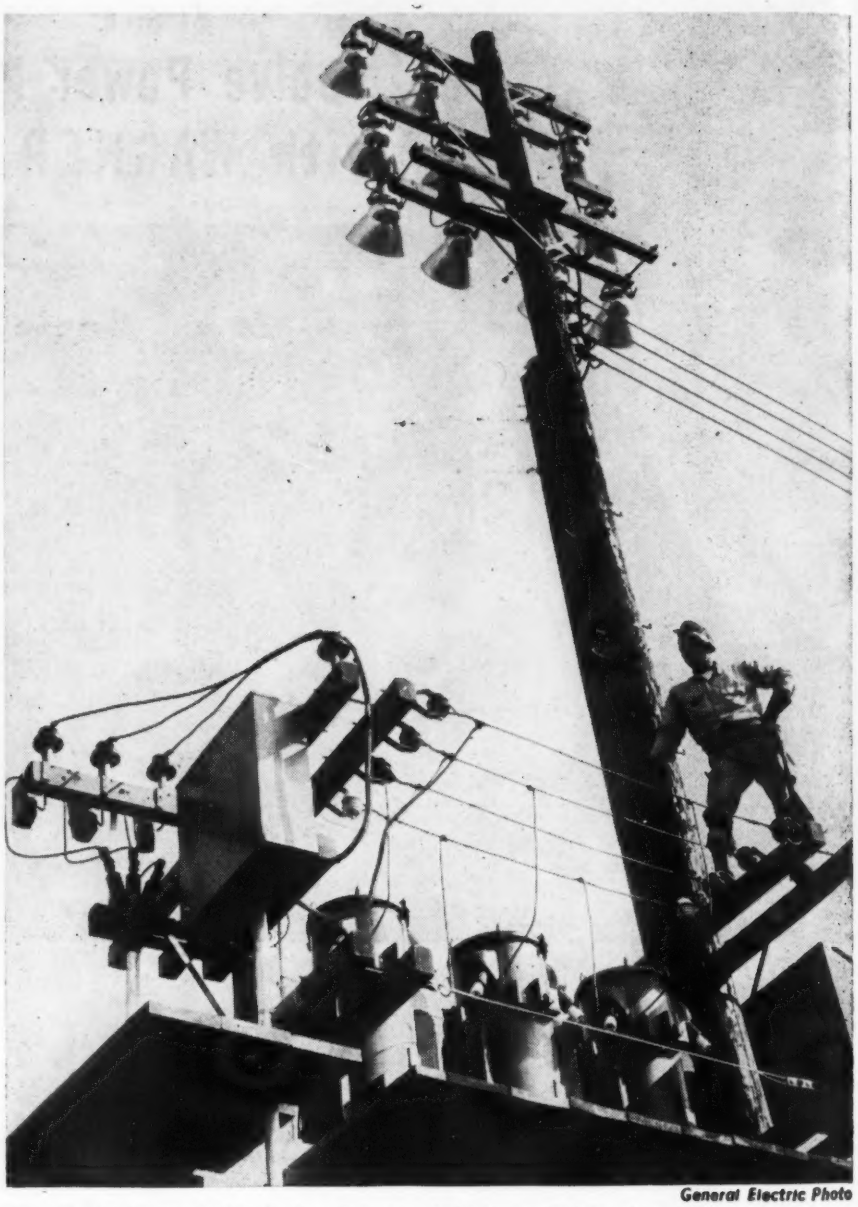
The resistors are connected to a silver-plated contact point and mounted within a stick made of Bakelite Dilecto XX. The milliammeter is mounted perpendicular to the stick in its insulated base and protected at the end by a thick transparent plastic cover. The grounding cord completes the series circuit from the resistors and milliammeter to ground. A rack on the stick holds the grounding cord when it is not in use.

Voltage Range Increased

First models built by Portland General Electric were calibrated to read 10,000 v full scale, but later models commercially manufactured will read 0-14,000 v to cover the 13-kv voltage range. Accuracy in the field is within 5%.

In testing for voltage to ground, the lineman first unrolls enough cord from the rack on the high potential stick to clip to a convenient ground. He then contacts the circuit with the silver plated contact point. Voltage is shown clearly by the milliammeter in the base, which will usually be directly in the line of sight and approximately an arm's length away.

To test phase-to-phase voltages the ground cord is clipped to a ring on the phasing stick. This ring leads through another ten megohms to a hook on the end of the stick. The complete unit is thus suitable for a wide variety of testing such as locating blown fuses and phasing at sectional switches and transformer banks.



General Electric Photo

POWER for 72 floodlights for San Francisco field is supplied by three 75-kva transformers

Newly Installed Floodlighting

AN H-FRAME stub pole with crossbar, supports a bank of three 75-kva transformers, switchgear, primary fuse, cutouts and metering equipment for lighting San Francisco's State College football field. The field is lighted by 72 type L-69 flood lights mounted on six 80-ft poles set atop high banks surrounding the field on three sides. Each floodlight is individually fused by the weatherproof fuse panel back of the bank of lights.

ECONOMICAL DEMAND METERING ON POLYPHASE CIRCUITS

TYPE CAH
combination Polyphase Watthour and Thermal Demand Meter

...even where the load is small!

Here's your answer to the problem of low-cost demand metering on polyphase circuits . . . for the *full range* of loads.

YOU CAN BE SURE..
IF IT'S
Westinghouse

New, low-cost Westinghouse polyphase Demand Meters combine a standard polyphase Watthour Meter and a Thermal Demand Meter into *one* compact unit. Their inherently low maintenance characteristics make possible the sound economy of demand metering on small *or* large loads. Only one mounting is required . . . taking up little more space than one three-element polyphase Watthour Meter. Installation is greatly simplified. A low first cost is made possible through simplified design.

Whatever your requirements may be . . . kw *or* kva demand meters . . . single-phase or polyphase . . . Westinghouse has the meter that will give you the *accurate* and *economical* information you need. For complete information call your nearest Westinghouse office or write for C. S. 42-338, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40364

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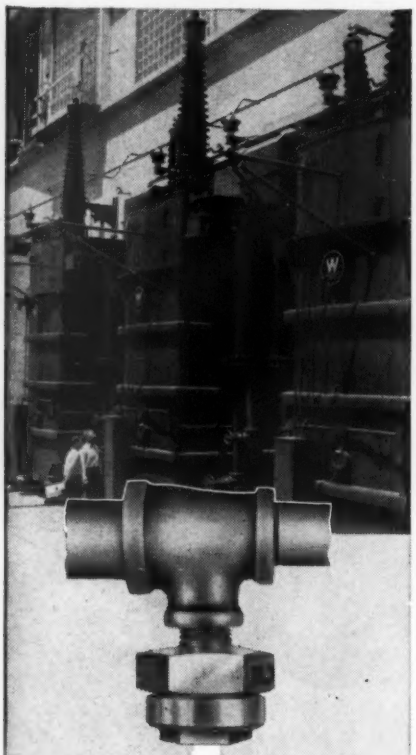
FOG SYSTEMS
OPERATE WITH THE SPEED OF ELECTRICITY



Activated by electric rate-of-rise supervised thermostats, they attack the fire instantly.

They spread a smothering cloud of fog over the fire, at the same time driving through to its base with a finely divided spray, cooling and quenching burning oil and inflammables.

Clear passages in these nozzles prevent clogging, and their spray pattern is maintained in emergencies even with reduced pressures.

Listed by Underwriters Laboratories, Inc.
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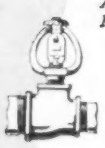

ALSO—
Blaw-Knox offers Standard Wet and Dry Pipe Systems, as well as Thermostatically Controlled Pre-Action and Deluge Systems.

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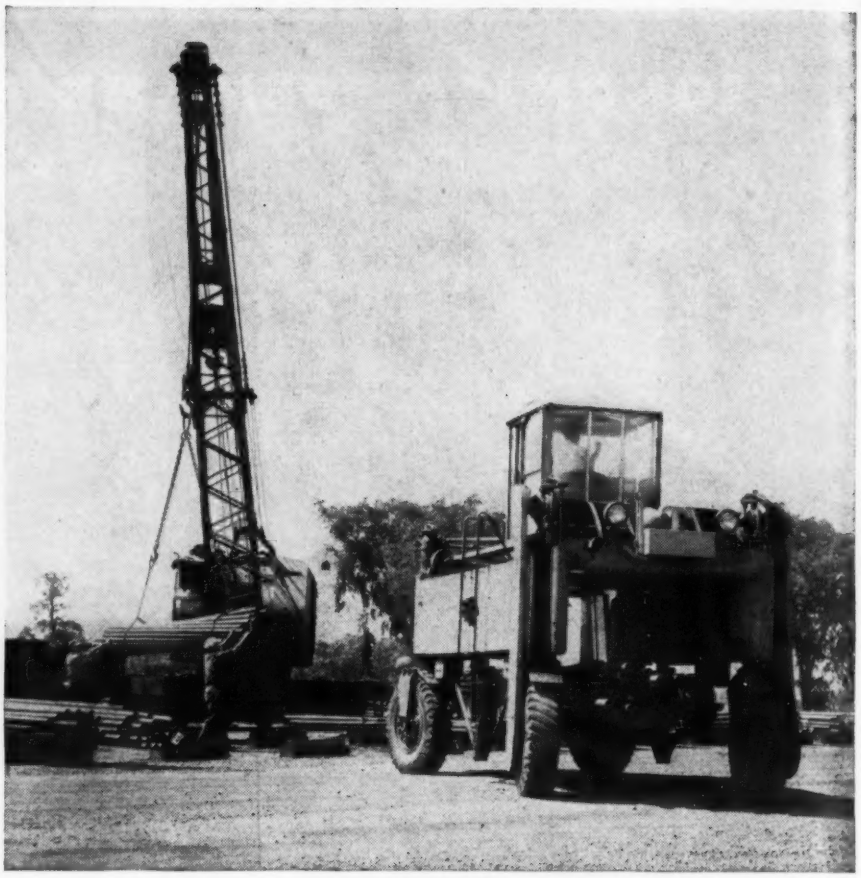

RADIO DISPATCHED straddle truck operator acknowledges a 2-way radio message from materials handling headquarters and picks up two bales of tubing

Radio Truck Dispatching Speeds Handling

LINE CONSTRUCTION contractors, and others faced with handling heavy materials over large areas, may find it very worthwhile to consider radio dispatching for solving difficult materials handling problems. For example, radio dispatching of three special trucks solved the complex materials handling problem of the 250 acre Gambrinus Plant of Timken Roller Bearing Company in Canton, Ohio.

Operation started in June. A month later, two trucks were handling 354 more bales of bars and tubes than three trucks did previously; with a saving of 39 operating hours.

The "open" control system permits any unit to haul any load to any destination at any time. There are no preconceived restrictive assignments. No truck works for a particular department exclusively, and both trucks may, if necessary, work in a single department to relieve impending stagnation of material flow.

To call a jam-breaking straddle truck into action, the operation foreman simply phones the dispatcher in the material handling office and the dispatcher relays instructions by radio to the truck driver.

The steady pace maintained by radio-controlled straddle trucks makes it possible to move material most urgently needed, while at the same time working out the greatest number of two-way truck loads.

A 30-w Motorola central station and three 10-w dispatcher units (two in the trucks and one in a station wagon ambulance) are used.

Electromagnetic-Fluid Clutch Operation

J. RABINOW
National Bureau of Standards

A NEWLY DEVISED magnetic fluid clutch discussed in detail before the recent Washington D. C. meeting of AIEE, operates on the following basic principle: When the space between two parallel magnetic surfaces is filled with finely divided magnetic particles and a magnetic field is estab-

For service under the worst conditions specify this New Non-Metallic Sheathed Cable

Durability that comes from a combination of chemical, electrical and physical properties possessed by no other plastic material to such a degree! That's the story on non-metallic sheathed cable—now insulated and sheathed with VINYLITE Brand Plastics.

Chemically—it gives utmost resistance to corrosive vapors, to most strong chemicals, to moisture, fungus growth and aging. Electrically—it has high dielectric strength, resistivity, and arc resistance. Physically—it withstands cold, heat, sunlight, abrasion and flame.

Thus VINYLITE Brand Plastic sheathed cables are of particularly outstanding utility in livestock houses, dairy barns, roadside stands, and other places where ordinary non-metallic sheathed cables may fail.

Affording utmost economy with long life, cables insulated and sheathed with VINYLITE Plastic materials are smooth, of small diameter, easy to install, mar- and impact-resistant and highly flexible. They slip easily through narrow spaces and around sharp corners without damage. It will pay you to investigate VINYLITE Plastics—as well as BAKELITE Polyethylene—insulated wire and cable. Write Department EK-28 today!

Vinylite BRAND **PLASTICS**

BAKELITE CORPORATION

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation UCC
30 East 42nd Street, New York 17, N.Y.

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When you order Koppers Creosote (or Koppers Creosote-Coal Tar Solutions), it's important to remember that you're getting products that have decades of dependable performance behind them . . . that have established enviable records as wood preservatives everywhere.

Send in your order now. And if you want to *play safe*, ask about Koppers yearly contracts that take care of your future needs.

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lished between the two plates, the magnetic particles bind the plates together against movement parallel to their surfaces. The magnetic particles may be finely divided iron which, for most applications, is mixed with a liquid such as oil, to prevent packing and to afford smoother operation of the clutch. When a portion of this mixture is acted on by a magnetic field, the iron particles are mutually attracted, bind together in the field, and the mixture "solidifies".

Applications

Experimental results obtained on the several forms of the magnetic fluid clutch suggest many possible uses for the new electro-magnetic device. Unlike fluid couplings of the type now common in automobiles, the clutch is not a speed-sensitive device. If the load is below the slipping torque of the clutch, no slippage occurs and the mechanical efficiency of the clutch is 100%. One broad field of applications is in constant-torque and overload devices where the clutch is never de-energized. Permanent magnet clutches are particularly useful for such service.

But the field where these new clutches are expected to find their main application is in servo-mechanisms. Here friction clutches have been used, but their lack of smoothness, the changes in characteristics caused by wear, their nonlinearity, and the poor reproducibility of results have given rise to great difficulties. The new clutch should go far toward solving such problems. While servo-mechanisms can be operated by variable speed motors, hydraulic transmission, and many other means, clutches and brakes have the very great advantage of low inertia-to-torque ratios. Electromagnetic clutches are particularly adaptable to serve as the final elements of electro-mechanical amplifiers.

Example

The electromagnetic-fluid clutch is relatively small for the power transmitted. A 6-in. dia 6½-in. long unit transmits 40 hp at 3,000 rpm.

The nature of the oil used in the magnetic fluid clutch has relatively little bearing on performance. Hence silicone liquids may be employed with excellent results, enabling the clutch to operate at very low and very high temperatures, an important consideration in some applications.

The Tougher the Job . . .

the more we can help. For Hoosier engineers are more experienced in handling the erection and maintenance jobs that have proved unusually difficult for utilities throughout the country. Hoosier engineers, trained men and special equipment are available at any time to supplement your own organization or work independently

ERECTION AND MAINTENANCE OF TRANSMISSION LINES

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HOOSIER
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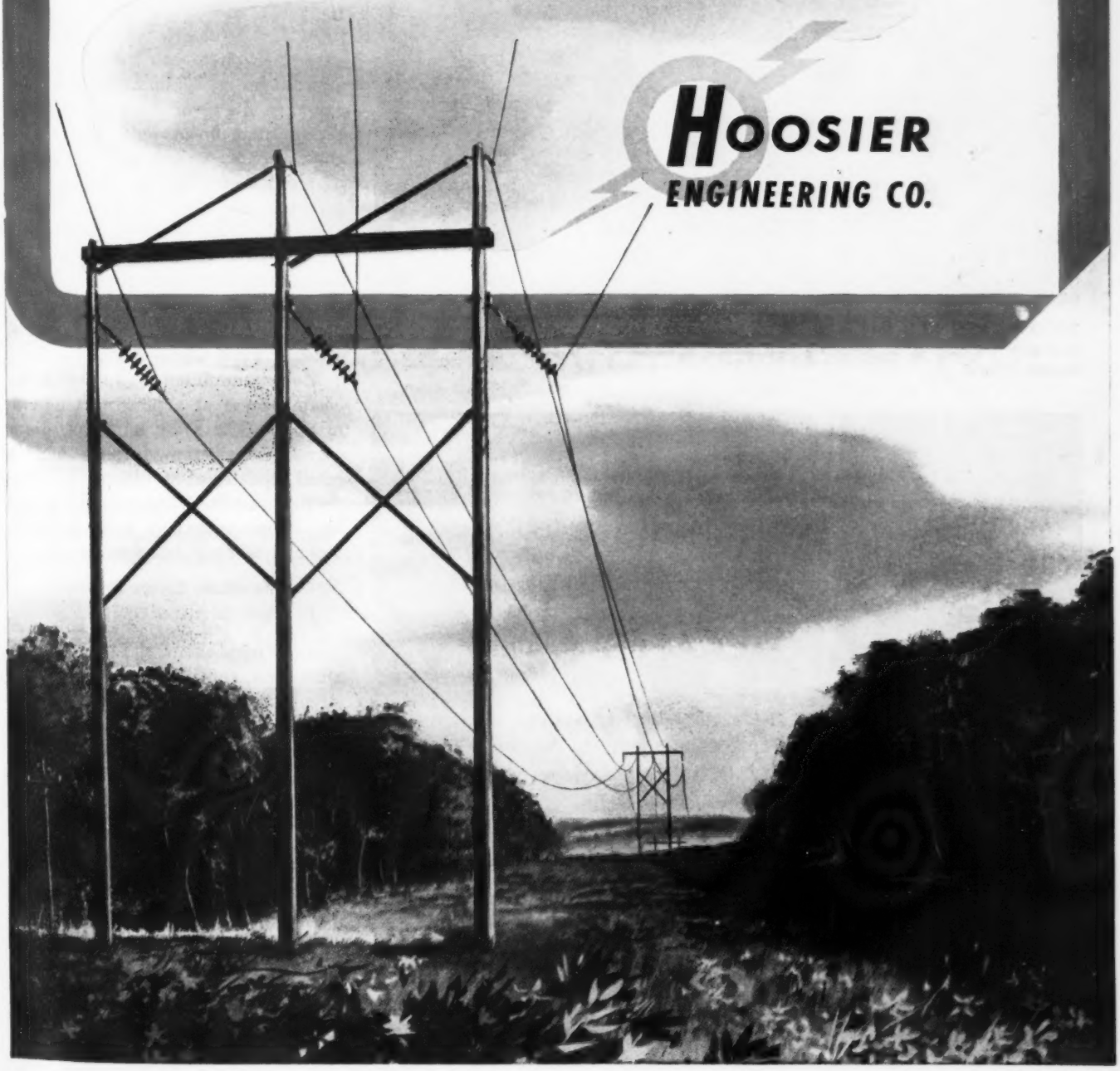
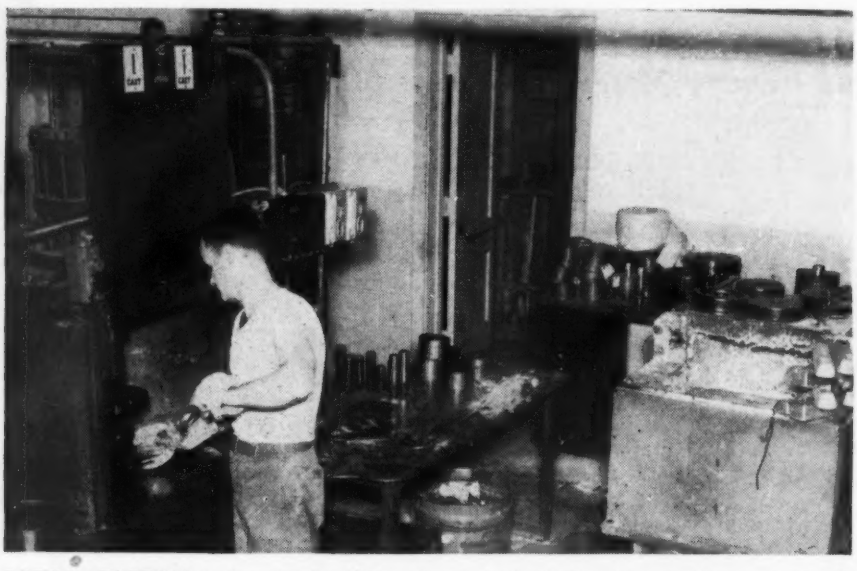


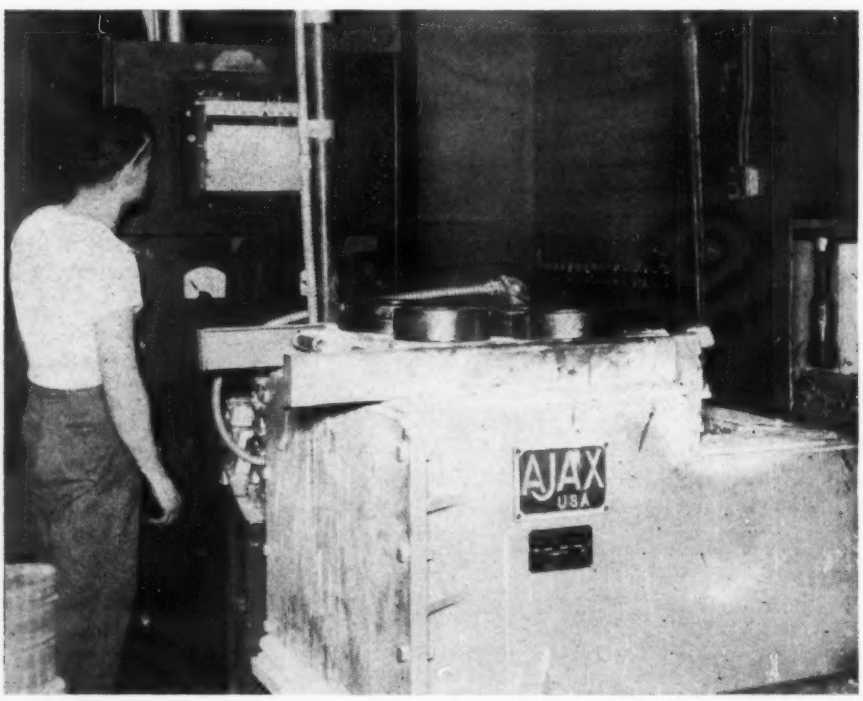
LOAD BUILDING

Electric Furnace Melts Aluminum For Rotor Castings

SELECTION of a 60-kw electric induction furnace, to melt aluminum used in the pressure casting of aluminum rotors at the new Ashtabula, Ohio, motor manufacturing plant of the Reliance Electric & Engineering Co, was based on several factors. Primary considerations were: (1) possibility of a gas shortage during prolonged cold spells, and (2) the low Btu content of the artificial gas supply which introduced a cost factor that was prohibitive. Secondary considerations were: (1) ability of this type furnace to maintain close temperature and chemical control, and (2) ability to accelerate quickly from holding to pouring temperature.



ROTOR CASTING is done in the 60-ton air-operated injection type casting press at left. Aluminum for casting the motor rotors is melted in 60 kw, 300 lb per hr electric induction furnace at right



PYROMETER CONTROLLER in rotor casting room keeps record of metal temperature in the induction furnace at right. Power factor indicator, below temperature recorder, shows when furnace needs cleaning

Integral Castings

At its Ashtabula plant, Reliance casts the aluminum rotors for its 1 to 20 hp a-c motors. These rotors range in diameter from 4¾ through 8½ in. and have their rotor bars, short-circuiting rings and fan blades cast as one integral section. This one-piece assembly contributes to a sturdy motor that can be stopped abruptly or reversed without vibration or fatigue failures. The casting operation is done in the 60-ton air-operated, injection-type casting press, shown.

Molten aluminum is supplied to the casting press at a pouring temperature of 1,325 F by an Ajax 60-kw twin-coil induction furnace with a rated capacity of 300 lb per hr. Production requirements are 225 lb per hr. Power supply is from a 440-v, 3-phase, 60-cycle bus-duct system.

Aluminum Closes Circuit

From a cold start the furnace is charged with about 300 lb of molten aluminum, sufficient to cover the recirculation tubes and establish the closed secondary circuit necessary in an induction furnace of this type. When the temperature of the bath reaches 900 F, pig aluminum is added. Time required to bring a full charge to pouring temperature is about two hr. The furnace operates continuously and holds the bath at 1,275 F during the night hours and when casting is not in progress. About 10 min is required in the morning to raise the bath from 1275 F to the pouring temperature of 1325 F.

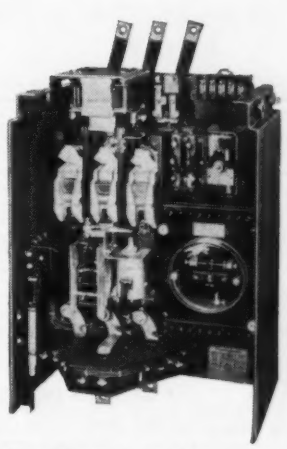
Temperature of the melt is held

. . . TO IMPROVED SERVICE CONTINUITY IN MEDIUM-DENSITY AREAS!

Now you can extend the advantages of a-c secondary network systems to medium-density areas . . . where there is a growing demand for improved service reliability, voltage regulation and system flexibility. You can do it economically, too, for the new CM-88 network protector was developed specifically for use in areas with overhead distribution lines where a modified or low-cost form of secondary network is practical. These would include small outlying business sections and heavily loaded residential areas in large cities, and the commercial districts in smaller cities and large towns.

The protector is an automatic, electrically-operated air circuit breaker, controlled by network relays. The opening of the protector automatically isolates a faulted primary circuit or network transformer *without interrupting the power supply to any consumer.*

In broadening the field for a-c network systems, Westinghouse offers a practical solution to your service problem in areas of lighter load density. For more information on the CM-88 call your Westinghouse office or write for booklet B-3977. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60670



The CM-88, light-duty, network protector removed from weatherproof enclosure. The unit can be mounted on a pole or crossarm with existing transformers.

Westinghouse NETWORK PROTECTORS

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

within 1% or less by automatic thermostatic control. The Brown recording-type temperature control unit, shown, makes it possible to maintain a day-to-day temperature log and, in the event of trouble, to determine whether the temperature of the metal was the factor responsible.

The induction furnace is used for regular production with a separate gas-fired pot for stand-by service. This makes it possible to cast either aluminum, alloys of aluminum or alloys of magnesium with no change in the rotor press.

Importance of Maintenance

Maintenance of the induction furnace has an important bearing on its efficient operation. Power factor is affected by sludge formation in the bottom furnace chamber and the three vertical channels as well as by cracks in the refractory lining. Consequently these vertical channels are "reamed" twice each shift, or more often as indicated by the power factor instrument in the furnace circuit. The bottom chamber is usually cleaned every two months.

10-Year Farm Market Projection

HARRY RESTOFSKI, West Penn Power Co., Pittsburgh, Pa.

REVENUE WILL HAVE RISEN 253%, energy usage 263%, and connected load 316%. These are estimates of 10-yr increases, 1948-1957, directly attributable to 10 major farmstead applications of electricity on the West Penn Power Co system. They result from a study of such equipment in use last year, on which 5- and 10-yr projections were based. The projections are the consensus of estimates made by company rural service personnel and are weighted to reflect growth in number of customers, 3,000 additions in the first 5-yr period and 1,000 in the second.

The combined contribution of the 10 applications to present average annual farm use of electricity is about 800 kwhr, 30% of the total. In 1957 these applications will account for 2,260 kwhr, about 50%, in the per customer annual average.

In the order of revenue-building importance, farm freezers stand in first place. Next comes water heating, with hay driers and dairy refrigeration following.

At present prices, equipment covered by the study and now in use has a retail value of $2,737,000. If the market develops as projected, the list value of equipment in use 10 years hence will aggregate $11,267,000.

Electric Application	Total Additions: 1947–1957				Totals as of 1957 (Present Plus Additions)			
	Units	KW	Annual KWH*	Annual Revenue	Units	KW	Annual KWH*	Annual Revenue
Dairy Refrigeration	3,022	1,511	4,351	$87,020	5,067	2,534	7,296	$145,920
Water Systems	5,952	1,984	2,143	42,860	13,794	4,598	4,966	99,320
Brooders	3,420	2,565	1,710	34,200	7,433	5,575	3,717	74,340
Water Heater#								
Less than 50 gal	2,271	1,136	3,815	76,300	3,133	1,567	5,263	105,260
50 gal or over	666	999	2,397	23,970	697	1,046	2,509	25,090
Farm Freezers	6,794	3,397	8,152	163,040	7,423	3,712	8,907	178,140
Milkers	2,557	1,279	920	18,400	4,477	2,239	1,611	32,220
Hay Driers	1,864	9,320	4,847	96,940	1,989	9,945	5,172	103,440
Feed Grinders	1,044	5,220	563	11,260	1,223	6,115	660	13,200
Silo Unloaders	610	1,830	427	8,540	614	1,842	430	8,596
Stable Cleaners	708	2,124	85	1,700	714	2,142	86	1,714
Totals		31,365	29,410	$564,230		41,315	40,617	$787,240

* Thousands
\# Barn use only

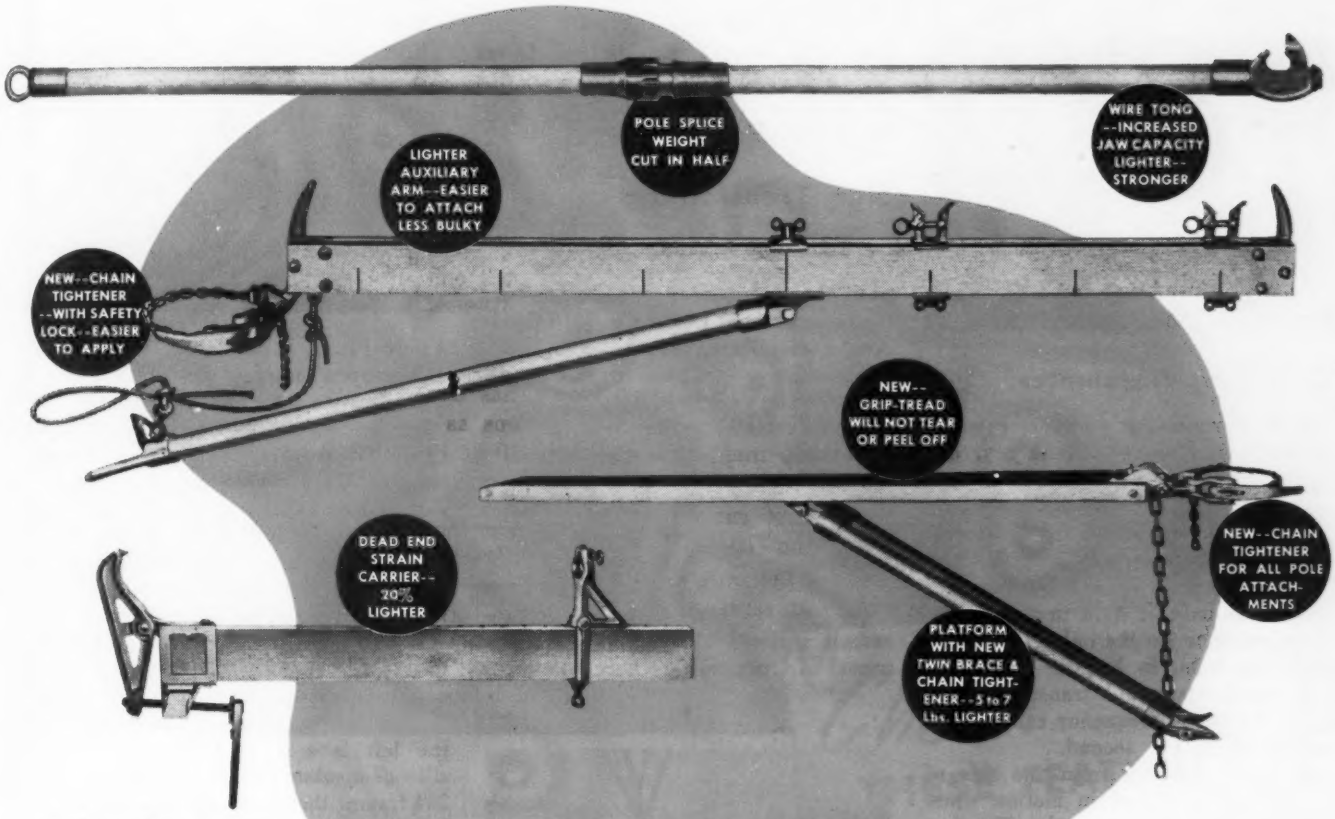
Analysis of Estimated Markets for 10 Farm Appliances for Next 10 Years—West Penn Power Co.

Electric Application	Total Market—1947 (number of present installations plus market potential)		Status—1947					5-Year Period Ending 1952					5-Year Period Ending 1957				
			Units in Use	Sat. %	KW	Annual KWH*	Annual Revenue	Add'l Units	Total Units in Use	Sat. %	Add'l KW	Add'l Annual KWH*	Add'l Units	Total Units in Use	Sat. %	Add'l KW	Add'l Annua KWH*
Dairy Refrigeration	4,598	Total Dairy Customers	2,045	44.5	1,023	2 945	$58,900	1,230	3,275	58.5	615	1,771	1,792	5,067	85.8	896	2,580
Water Systems	13,982	Total Farm Customers	7,842	56.1	2,614	2,823	56,460	2,957	10,799	63.5	986	1,065	2,995	13.794	76.7	998	1,078
Brooders	6,901	153% of Poultry Customers	4,013	58.2	3,010	2,007	40,140	1,702	5,715	68.2	1,277	851	1,718	7,433	84.0	1,288	859
Water Heater# Less than 50 gal	3,433	75% of Dairy Customers	862	25.1	431	1,448	28,960	1,072	1,934	46.4	536	1,801	1,199	3,133	71.0	600	2,014
50 gal or over	1,165	25% of Dairy Customers	31	2.7	47	112	1,120	184	215	15.3	276	662	482	697	46.6	723	1,735
Farm Freezers	11,076	79% of Total Customers (for freezers over 15 cu. ft.)	629	5.7	315	755	15,100	2,442	3,071	22.8	1,221	2,930	4,352	7,423	52.2	2,176	5,222
Milkers	4,598	Total Dairy Customers	1,920	41.8	960	691	13.820	1,040	2,960	53.0	520	374	1,517	4,477	76.0	759	546
Hay Driers	3,700	80.5% of Dairy Customers	125	3.4	625	325	6,500	573	698	15.5	2,865	1,490	1,291	1,989	41.8	6,455	3,357
Feed Grinders	4,598	Total Dairy Customers	179	3.9	895	97	1,940	358	537	9.6	1,790	193	686	1,223	20.7	3,430	370
Silo Unloaders	2,407	52.5% of Dairy Customers (are those dairy farms with silos)	4	0.2	12	3	56	144	148	5.1	432	101	466	614	20.0	1,398	326
Stable Cleaners	1,549	33.7% of Dairy Customers (are those dairy farms with herds of 20 cows or more)	6	0.4	18	1	14	217	223	11.9	651	26	491	714	35.8	1,473	59
	Totals				9,950	11,207	$223,010				11,169	11,264				20,196	18,146

* Thousands
\# Barn use only

CHANCE *HOT LINE TOOLS*

with Aluminum Alloy Fittings


POLE SPLICE WEIGHT CUT IN HALF
LIGHTER AUXILIARY ARM--EASIER TO ATTACH LESS BULKY
WIRE TONG --INCREASED JAW CAPACITY LIGHTER-- STRONGER
NEW--CHAIN TIGHTENER --WITH SAFETY LOCK--EASIER TO APPLY
NEW-- GRIP-TREAD WILL NOT TEAR OR PEEL OFF
DEAD END STRAIN CARRIER-- 20% LIGHTER
NEW--CHAIN TIGHTENER FOR ALL POLE ATTACH-MENTS
PLATFORM WITH NEW TWIN BRACE & CHAIN TIGHT-ENER--5 to 7 Lbs. LIGHTER

Lighter—Stronger—Safer...

for Live Line Maintenance

Chance live line maintenance tools are lighter, stronger, safer, and easier to use. The line has many features that simplify operation and increase the versatility of the tools.

Amazing weight reduction, with increased strength, is made possible by the use of cast aluminum alloy fittings. Tests prove that even a slight difference in the weight of a tool head makes a considerable difference in the effort required to handle the tool from the butt end. This reduced weight minimizes fatigue and helps linemen do their work more quickly, efficiently and with less effort. Every tool has been proven *stronger* than the old design with heavy bronze fittings. All castings are rigidly inspected and production samples are regularly X-ray tested to guard against defects. All wood poles are voltage tested, to assure utmost safety, both before and after fittings are applied.

Linemen, foremen, superintendents and safety directors who have handled these new Chance tools are enthusiastic about the many points of superiority they offer over all previous hot line tools.

Write for complete information.

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ABC INDUSTRIES

C4710

NEW EQUIPMENT

Recording Vibrometer

A NEW recording vibrometer which measures and records frequency, displacement, and wave shape of mechanical vibration, has been announced by Special Products Division of General Electric Co, Schenectady 5, N. Y.

Built to operate either when mounted on a fixed base or held in the hands, the vibrometer weighs only 7 lb and is less than 8 in. in length. It records both steady-state and transient vibrations. Vibration frequency range is 10 to 120 cycles per second.

A prod extending from one side of the vibrometer is set in motion when held against a vibrating body. This motion is amplified by a cross-spring arrangement and transmitted to a stylus which inklessly records the vibration on wax paper. Another stylus produces a timing mark near the edge of the wax paper every one-third of a second. Both the chart speed and the interval between timing marks are governed by a synchronous motor operated from a 115-v, 60-cycle power supply. Two push buttons are provided to give chart speeds of 1 in. per sec. and 3 in. per sec. A chart roll has 50 ft of paper.

•

Ultraviolet Lamps

LOW PRESSURE mercury arc lamps, a source of long wave ultraviolet light, are made under the name Raymaster blacklight lamps by George W. Gates & Co, Inc, Franklin Square, Long Island, N. Y.

Filtered to produce practically no radiations shorter than 3,000 A, the lamps are said to have an energy peak of nearly 3,600 A with no attendant ill effects on eyes or skin.

Ratings available in ⅞ in. dia tubes are 4 w, 6 in. long; 6 w, 9 in. long; and 8 w, 12 in. long. Lamps of 15 w, 18 in. in length, and 30 w, 36 in. in length, are made with 1½ in. dia.

•

Sign Transformers

FELCO luminous-tube transformers feature coil design and placement said to minimize electrical stresses. They are made by Forest Electric Co, 7216 Circle Ave, Forest Park, Ill.

Short leads are used to prevent destructive corona action. Balanced design with midpoint grounding reduces radio disturbance and protects secondary coils from burn-outs due to grounds or defective tubing. Shockproof insulator caps may be attached in any of four positions.

Double-sealed case is finished in black enamel and exposed metal is cadmium plated. Transformers have approval of Underwriters Laboratories.

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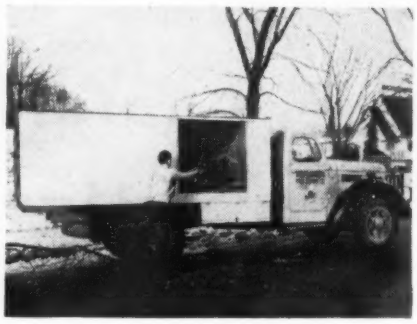


Branch Disposal

PROBLEMS of disposing of brush following line clearance work are claimed to be solved by the Chipper, a branch-reducing machine developed by Asplundh Tree Expert Co, Jenkintown, Pa.

Purpose of the machine is to reduce brush to chips. The manufacturer advises that through use of the unit, long hauls and burning costs are eliminated; dump charges and loading costs are reduced.

•

Induction Motor

SILICONE resins for winding insulation and silicone grease for bearing lubrication make possible a totally enclosed non-ventilated motor in a 5-hp, 4-pole rating in the same frame size as the open motor of the same rating. This permits reductions of as much as three frame sizes from present standard Class A insulated totally enclosed motors. The efficiency, power factor and torque of such a motor are reported to be comparable to those for an open motor of the same rating. This development of the high-temperature Life-Line a-c induction motor is announced by Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa.

Accompanying illustration shows the size reduction possible. The motor on the left is a 5-hp, 1750-rpm, 4-pole, silicone-insulated all-steel motor in the 254-frame; the one on the right is rated the same but is Class A insulated and is in a 326-frame. Weight is reduced from 250 to 145 lb, or is 60% of the Class A insulated motor. Height is reduced 3¼ in.; length, 7¼ in.

•

Thickness Detector

BRANSON INSTRUMENTS, Inc, Joe's Hill Road, Danbury, Conn., has announced the model FMSS-5 Audigage thickness detector for determining thicknesses of metals, glass, plastics or other materials. According to the manufacturer, measurements need be made from one side only, regardless of back-up liquids or scale deposits.

An X-cut quartz-crystal oscillator generates and transmits ultrasonic waves into material under test. The instrument is then tuned to the resonant frequency of the unknown thickness. Resonance is indicated simultaneously by headphones and milliammeter. Resonant frequency can be converted to thickness by use of conversion scale on instrument.

The detector has features which include adjustable frequency modulation, increased frequency range and perme-

HUBBARD GUY CLAMPS

1. The *straight groove* eliminates the possibility of drawing a nut tight against an "arched" section which is out of contact with the strand. Hubbard Clamps have full clamping area. Hold to breaking strength of most strands.

2. The *straight groove* fits any and all twists, right or left hand and a variation in diameter without *creating* any high spots to *lessen clamping area.*

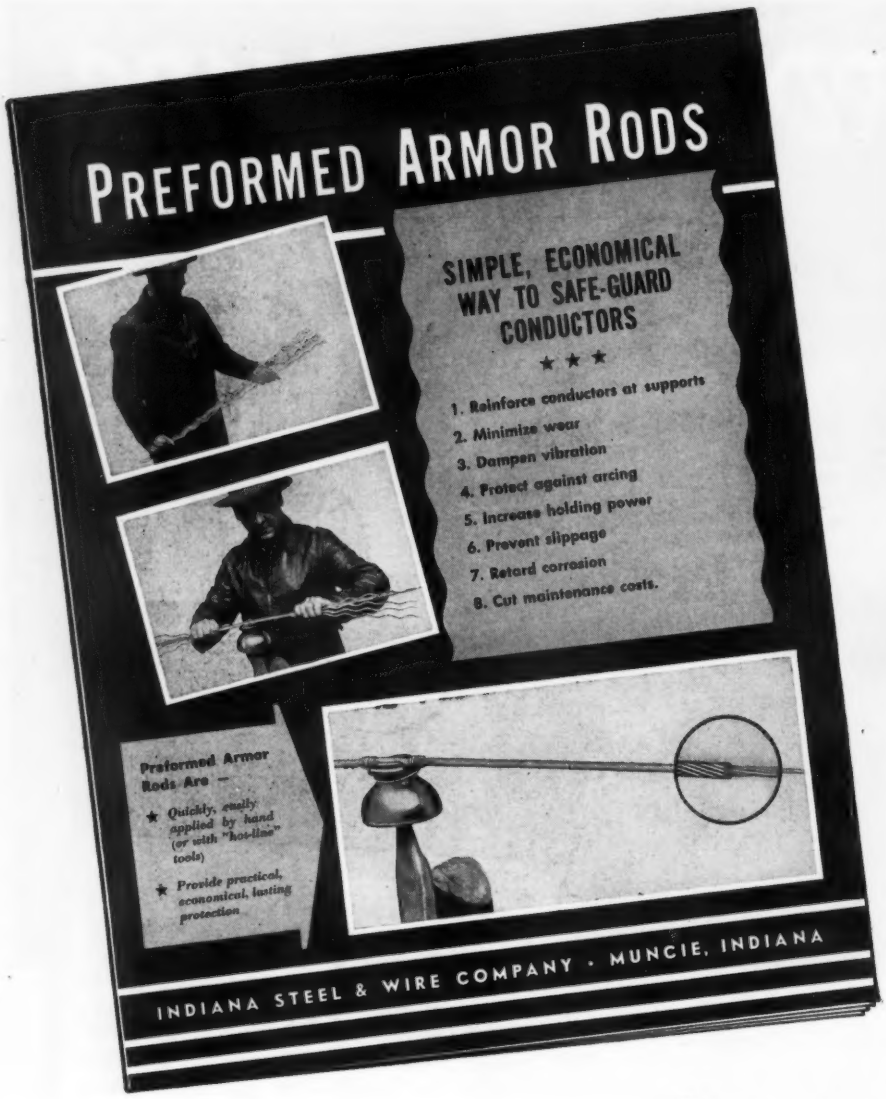
3. Bell-end grooves prevent injury to the strand caused by the sharp corners at the ends of the grooves of some clamps.

4. High carbon bolts prevent stripping or elongation. Heads are locked against turning while tightening—and the whole clamp is protected against corrosion by the best process commercially used—HUBBARD DOUBLE-DIP HOT GALVANIZING.

5. The range of strand sizes accommodated by No. 7461 Guy Clamp, without sacrifice of holding strength in any size, can not be matched by any other style of clamp. Exhaustive tests have been made on specially designed clamp sections, patented shapes and various snubbing ideas, all of which have failed to measure up to the HUBBARD straight, smooth groove type of clamp.

HUBBARD AND COMPANY

PITTSBURGH CHICAGO **OAKLAND, CALIF.**


PREFORMED ARMOR RODS
SIMPLE, ECONOMICAL WAY TO SAFE-GUARD CONDUCTORS
★ ★ ★
1. Reinforce conductors at supports
2. Minimize wear
3. Dampen vibration
4. Protect against arcing
5. Increase holding power
6. Prevent slippage
7. Retard corrosion
8. Cut maintenance costs.
Preformed Armor Rods Are —
★ Quickly, easily applied by hand (or with "hot-line" tools)
★ Provide practical, economical, lasting protection
INDIANA STEEL & WIRE COMPANY · MUNCIE, INDIANA

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PREFORMED ARMOR RODS provide a simple, practical, economical method of reinforcing and protecting overhead conductors at the point of and in the region of the supports. They minimize wear and chafing, tend to absorb and dissipate vibration, protect the conductor against arching and flash-overs, afford increased holding power against slippage, lessen the possibilities of corrosion, reduce overall maintenance expense.

Easily applied by hand or with "hot line" tools. Available in galvanized or stainless steel, aluminum, copper or bronze.

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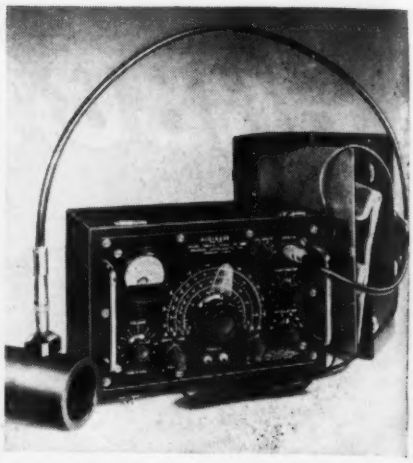

ability tuning unit for full range sensitivity. The portable instrument is battery operated, although a unit for a-c power can be furnished.

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Mash Welders

THREE-PHASE welding machines for mash welding transformer housing tanks are now built by Sciaky Bros, Inc, 4915 W. 67th St, Chicago 38, Ill. The units are designated type PMM3TL. Rated at 200 kva, the units are controlled electronically for squeeze, heat, cool and off time operations.

The machines are reported to be capable of mash welding two thicknesses of 0.109 in. of mild steel. They are provided with four hydraulic cylinders to produce clamping pressure of 48,000 lb along the seam, and have a throat depth of 52 in. They are also said to have an automatic, hydraulically operated locating fixture for determining the metal overlap at the seam.

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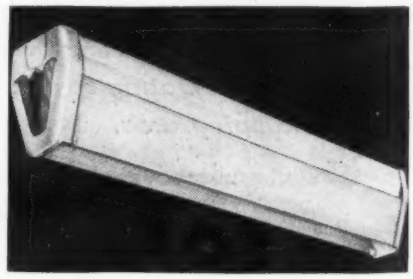


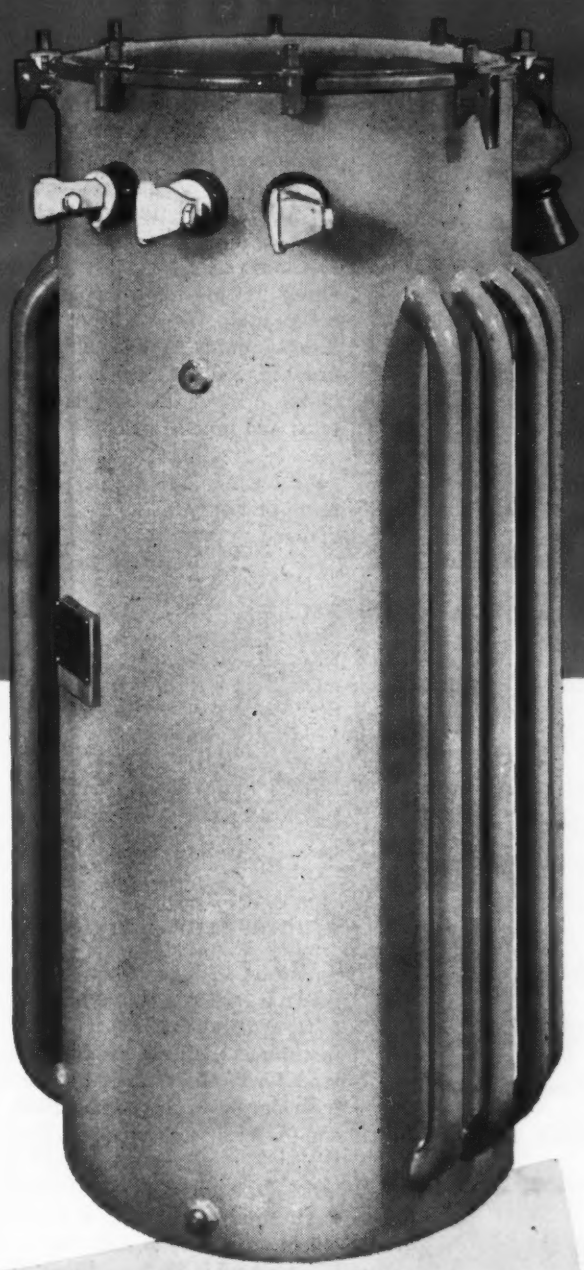
Fluorescent Fixtures

TWO FLUORESCENT fixtures, Peabody CSG-120 (illustrated) and Peabody CSG-140, have been introduced by Sylvania Electric Products Inc, New York 18, N. Y. These units consist of unshielded single lamp 20-w and 40-w fixtures, respectively, to which removable ribbed glass diffusing panels and metal end caps have been added.

Both models can be installed individually or end to end. For perimeter

AMERTRAN DISTRIBUTION TRANSFORMERS

for top performance today and TOMORROW



AmerTran Pocket-Type High Voltage Distribution Transformer—50 kva—5 kv class. All AmerTrans meet or exceed the most stringent requirements of A.I.E.E., A.S.A., E.E.I. and N.E.M.A.

● Enduring service with minimum maintenance is characteristic of AmerTran Distribution Transformers. Once they are installed, you can count on AmerTrans to give dependable, trouble-free performance day in and day out.

Today's AmerTrans are the focal point on which is concentrated almost 50 years of specialization in the design and manufacture of high quality transformers. Many AmerTrans built almost half a century ago are still in daily service.

To you this is assurance that the AmerTran you buy today is the best AmerTran ever made—and the best AmerTran ever made is the most efficient and economical transformer you can buy.

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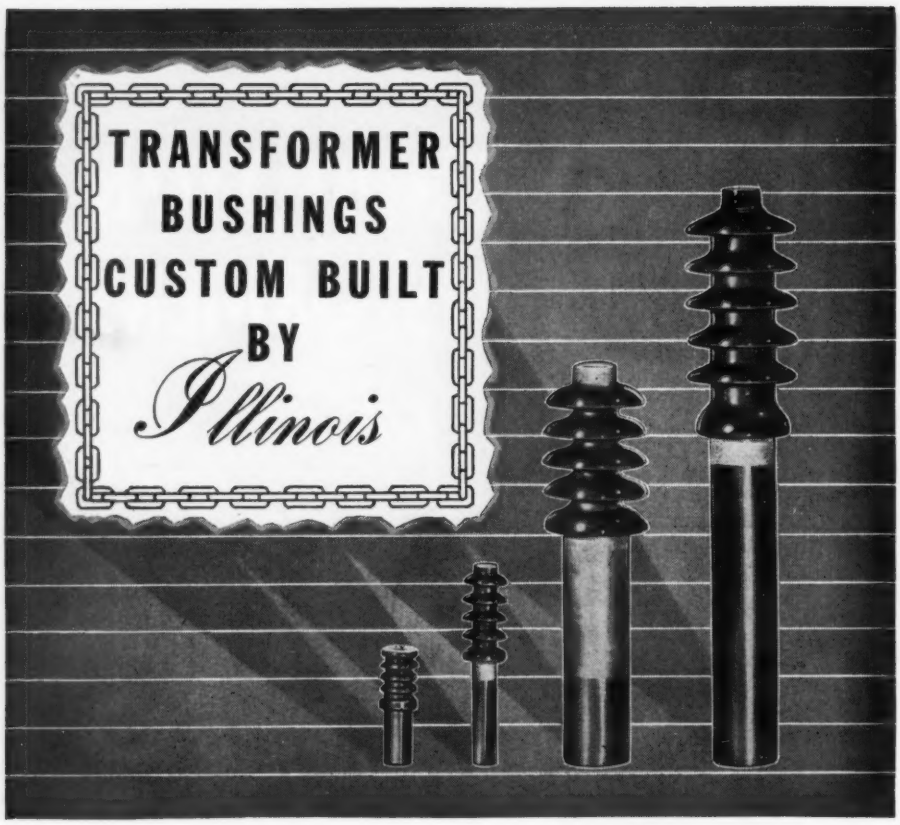

A chain is only as strong as its weakest link. Prevent weak links in your product by using ILLINOIS bushings produced to meet your engineers' most exacting specifications.

ILLINOIS' thorough control of production methods results in the manufacture of porcelain bushings of high dielectric and great mechanical strength, with the utmost in dimensional accuracy. Careful kiln drying and firing, at constant temperatures, prevent internal stress.

These bushings can be standard glaze or radio interference-proof glaze. Dry type bushings are produced for all voltages up to 34.5 kv. Gasket seats are smooth and ground when required.

★

Complete Uniformity
Exact Dimensions
High Dielectric Strength
High Mechanical Strength

★

Specify Illinois Porcelain
for Dependability and Economy

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB · ILLINOIS

continuous-row lighting, right angle bends can be made with curved fittings. Joining is done by conventional bushings and locknuts with knockouts provided at end of housings for wire-way.

Fixtures have steel chassis, with welded socket mounting straps; are finished in white Mirocoat.

•

Magnetic Separator

DESIGNED to remove tramp iron from heavy, free-flowing material non-electrically, an alnico magnetic separator, the "Giant", is being made by Eriez Mfg Co, 335 E. 12th St, Erie, Pa.

Face plates are built of abrasive-resistant steel and are furnished in either flat or stepped pole types. Magnets, ranging in size from 6 in. up, are also available in odd shapes upon request. Separators can be specified for either open-chute installation or with latch and hinges for closed chutes. Both models are insulated to prevent magnetic leakage and are designed to withstand temperatures to 600 F, it is claimed.

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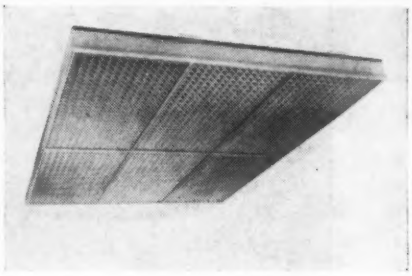


Fluorescent Units

PANELUX is a complete luminaire made in sizes 12 in., 16 in., 2 ft, and 4 ft wide and all 8 ft long. Manufacturer is Lighting Products Inc, Highland Park, Ill. The units can be used individually or in combination, joined end-to-end or side-by-side. They can be surface or pendent mounted or inset level with ceiling or false ceiling.

These units carry 2, 4, 6 or 8 lamps (96-in. Slimline) at 120, 200 or 300 ma. Light cut-off is 38 deg. Fiber-board and metal louvers are available. By combining units of various sizes, it is possible to develop complete louvered ceilings or large louvered panels.

•

D-C Millivoltmeter

DESIGNED for measuring minute values of direct current or voltage, the Millivac, Model MV-17A, vacuum tube millivoltmeter is made by Millivac Instruments, Box 3027, New Haven, Conn.

The meter contains a high impedance,

WHY THE *Experts* PREFER

FEDERAL NOARK BUS DUCT

DESIGNING ENGINEER-ARCHITECT

"I *like* to lay-out Federal NOARK Bus Duct! I can draw up the standardized units as soon as the plant layout is established. And, because there's a plug-in receptacle on either side—on one-foot centers—I don't have to worry about the exact position of every machine and motor."

INSTALLING ELECTRICAL CONTRACTOR

"Installing Federal NOARK Bus Duct makes my organization look good! Every unit lines up perfectly—drop hangers slide in position for exact alignment . . . and we don't have to worry about ceiling or wall conditions. The job is tops for speed, too—so it frees my crew for other profitable jobs!"

MAINTENANCE ELECTRICIAN

"My boys are in favor of Federal NOARK Bus Duct *safety*—and so am I! When you're standing on a fourteen-foot ladder, you're glad that the plug-in receptacles are *insulated*. And, when there's lots of machines to 'hook-up' it's a great help to have a Bus Duct you can get at from *either* side."

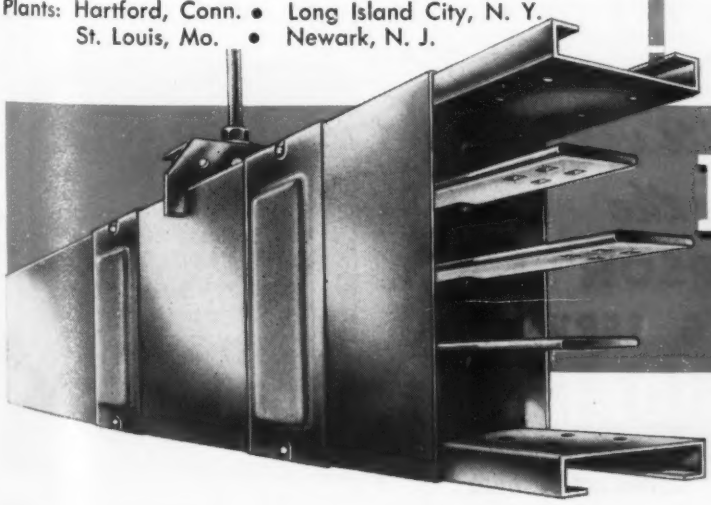
TOP MANAGEMENT

"We like the production figures we find wherever Federal NOARK Bus Duct is installed. *Uninterrupted production*—with no shut-downs for maintenance or relocation of machines—is a great thing these days! And, if we ever move our plant or departments—we'll be glad that Federal NOARK Bus Duct is completely salvageable!"

Write for Bus Duct Catalog
"It stays on the job!"

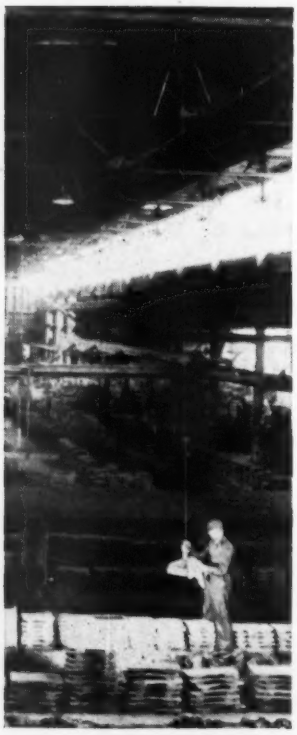
Executive Offices: 50 Paris Street, Newark, N. J.
Plants: Hartford, Conn. • Long Island City, N. Y.
St. Louis, Mo. • Newark, N. J.

FLEXIBLE, ECONOMICAL, EFFICIENT, SAFE—that's why so many top designers, technical men, and executives who have seen Federal NOARK Bus Duct in action in major industrial plants rely upon it to solve all secondary power distribution problems. And that's why you'll be in favor of Federal NOARK Bus Duct, too!



Federal NOARK Bus Duct

Federal Electric Products Company, Manufacturers of a Complete Line of Electrical Products, including Motor Controls • Safety Switches • Service Equipment • Circuit Breakers • Panelboards • Switchboards • Bus Duct



THOMPSON
DISCONNECTING & LOWERING
HANGERS

Put an END to Dangerous "In-the-Air" Lighting Fixture Cleaning and Relamping OUTDOOR — INDOOR

THE modern Thompson Hanger eliminates the old "up-in-the-air" method of cleaning and relamping which is both dangerous and expensive.

By this method the work is done at ground level, easier—faster—at lower cost and with complete safety as there is no electrical, climbing or ladder hazards.

Other advantages—ordinary labor can perform routine servicing—accessibility promotes frequent and regular servicing—more light output from your clean equipment—applicable to practically all types of lighting situations.

We invite you to use the
THOMPSON ENGINEERING SERVICE

THOMPSON
DISCONNECTING & LOWERING
HANGERS

THE THOMPSON ELECTRIC CO.
1101 POWER AVENUE • CLEVELAND 14, OHIO

shunting contact type, magnetic modulator which converts the input voltage into a 120-cycle carrier wave which is then amplified, rectified and metered. Stability has been increased because of a built-in voltage regulator and the absence of bridge circuits.

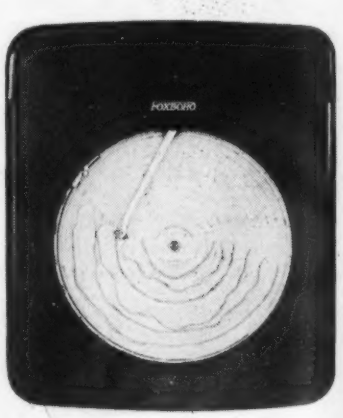
Measuring 1 mv full scale on its lowest range at 6 megohms input impedence, the meter has 12 additional ranges up to 1000 v full scale at 60 megohms input impedence. It also reported to read 150 $\mu\mu$ amp, full scale; up to 100 million megohms, using an external voltage source; and better than 10 db below 1 mv when used with a sensitive RF thermocouple.

•

Electronic Recorder

CAPABLE of measuring temperature, conductivity or other process variables, the Multi-Record Dynalog Electronic Recorder keeps from one to six simultaneous records on one circular chart. The manufacturer is The Foxboro Co of Foxboro, Mass.

Although the recorder has only one measuring system, either resistance bulb or emf type, an automatic switch-



for HIGH Resistances

SPECIFICATIONS

RANGE: 2,000 ohms to 50,000 megohms in five overlapping ranges; zero to 100 volts, d-c as a vacuum-tube voltmeter.

ACCURACY: within ±5% of indicated value from 30,000 ohms to 3 megohms; within ±8 % from 3 to 3,000 megohms when the central decade of scale is used. Voltage measurement accuracy is ±2% of full scale.

SCALE: standard direct-reading ohmmeter calibration is used; scale is illuminated.

VOLTAGE ON UNKNOWN: does not exceed 106 volts and varies with meter indication.

INPUT RESISTANCE: for voltage measurements input resistance in megohms is indicated by selector switch. On the "infinity" position, resistance is greater than 20,000 megohms.

TEMPERATURE-HUMIDITY EFFECTS: over normal room temperature and humidity ranges, accuracy is substantially independent of either.

DIMENSIONS: 10 x 8 x 5½ inches.

WEIGHT: 8½ pounds, net.

THIS NEW MEGOHMMETER is very similar to the usual ohmmeter except that a vacuum-tube voltmeter is used as the indicating device. It is a-c operated and direct-reading in five overlapping ranges from 2,000 ohms to 50,000 megohms. The a-c power supply is regulated to make readings of the instrument independent of supply voltage variations.

This megohmmeter is very useful for moderately high resistance measurements such as leakage resistance of cables and insulating samples, locating defective insulation in electrical machinery, and particularly for the determination of moisture content of wood, paper and other products. By means of a panel switch it is convertible to use as a d-c vacuum-tube voltmeter for measurements up to 100 volts, d-c.

The Type 1861-A Megohmmeter is convenient to use, accurate and stable.

TYPE 1861-A MEGOHMMETER $130.00

GENERAL RADIO COMPANY Cambridge 39, Massachusetts

90 West St., New York 6 — 920 S. Michigan Ave., Chicago 5 — 950 N. Highland Ave., Los Angeles 38

3 PEOPLE PROFIT

by using
WHEELER BRICK-TYPE BALLASTS

THE MANUFACTURER

of fluorescent lighting fixtures profits through the good basic design and engineering, skilled manufacture and rigid inspection of Wheeler Brick-Type Ballasts in his product. He is thus assured of rated light output, full lamp life and trouble-free performance.

MAINTENANCE MEN

profit through fewer, less frequent replacements in their fluorescent lighting installation. If their fixtures are equipped with Wheeler Brick-Type Ballasts, they'll devote less time to annoying and costly replacement jobs.

THE WHOLESALER

will profit by stocking Wheeler Brick-Type Ballasts. Maintenance men, lighting repair and installation people and other ballast customers will appreciate the availability of a dependable, quality ballast. Satisfied customers mean more profit — through purchases of ballasts and other components.

WHEELER BRICK-TYPE BALLAST

Available for the operation of two lamps in the following ratings: 40 watt 118 volt 60 cycle, certified by Electrical Testing Laboratories, Inc.; also for 220 volt 50 cycle and 220 volt 60 cycle. These ballasts are built to rigid specifications by Wheeler craftsmen. All are approved by Underwriters' Laboratories.

WRITE TODAY FOR COMPLETE BALLAST INFORMATION

THE WHEELER INSULATED WIRE CO., INC.

SERVICE QUALITY WHEELER DEPENDABILITY

DIVISION OF THE SPERRY CORPORATION
1311 WASHINGTON AVENUE
BRIDGEPORT 4, CONNECTICUT
MAGNET WIRE • COILS • COMMUNICATIONS EQUIPMENT

ing unit brings the vari-colored pens into position at six-sec intervals. The pens are magnetically selected in any predetermined sequence.

A dry ink is said to give clean recording for several weeks without refilling. Illustrated bulletin 428 explains other features of the recorder.

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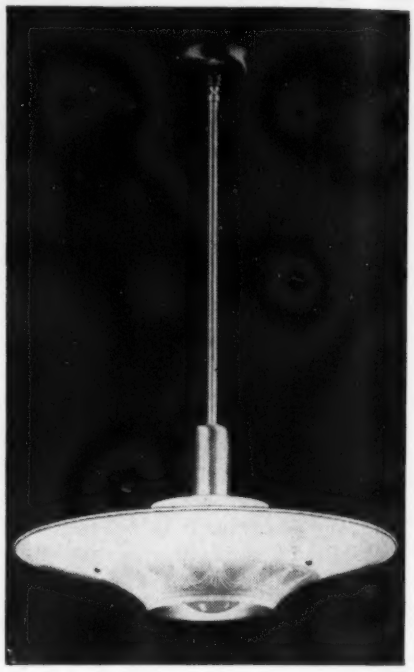
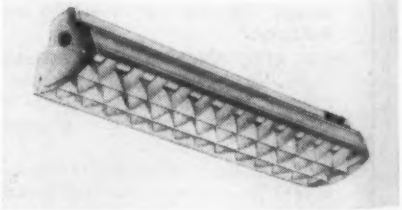


Tempered Glass Fixture

DEVELOPING IT specifically for schoolroom use, Appleman Art Glass Works, Bergenfield, N. J. now manufactures the Spill-lite, a lighting fixture made of Temprex glass.

The unit, using one 300 or 500-w bulb, is provided with a curved bowl that reportedly expels dirt, bugs or debris and allows bulb-changing from the floor. The silvered bowl assembly, 30 in. long and 21 in. wide, is finished in satin chrome and suspended on a swivel type rod.

•

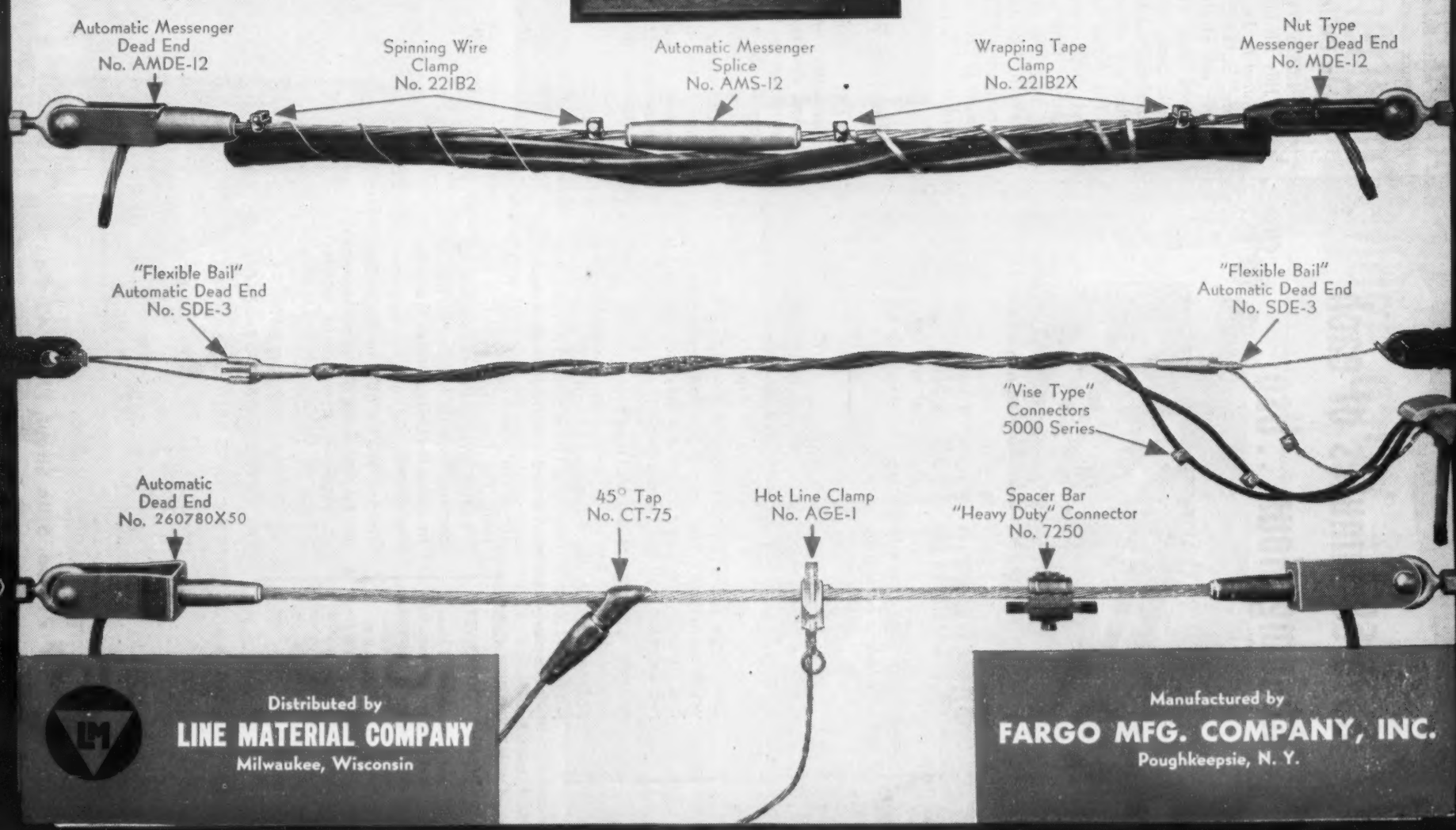


General Lighting Fixture

A LIGHT FIXTURE designed for general use is the SM-440 Luminaire produced by Leader Electric Co, 3500 N. Kedzie Ave, Chicago 18, Ill. Light diffusion is claimed to be 40% upward (indirect) and 60% downward (direct).

The all-metal unit affords variable

FARGO


Automatic Messenger Dead End No. AMDE-12
Spinning Wire Clamp No. 221B2
Automatic Messenger Splice No. AMS-12
Wrapping Tape Clamp No. 221B2X
Nut Type Messenger Dead End No. MDE-12
"Flexible Bail" Automatic Dead End No. SDE-3
"Flexible Bail" Automatic Dead End No. SDE-3
"Vise Type" Connectors 5000 Series
Automatic Dead End No. 260780X50
45° Tap No. CT-75
Hot Line Clamp No. AGE-1
Spacer Bar "Heavy Duty" Connector No. 7250

Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N. Y.

Save 58 minutes of each Rodding Hour... Use

PNEUMATIC FISH LINE

an air-operated device for fishing duct: it will do the job with *fewer men* and will do it faster.

One large public utility reports that rodding by conventional methods averages $15.20 per thousand feet, but, by using the Cope Pneumatic Fish Line, the cost is reduced to $2.60 per thousand feet.

Another user reports a specific operation. "An old 5" diameter fibre duct 209 feet long, containing considerable water, was fished in 2 minutes 40 seconds—a job that would ordinarily take 1 hour and 45 minutes, and twice as many men if performed by conventional methods."

WHAT PROBLEM CAN WE HELP YOU SOLVE?

Just as Cope found there was need for a Pneumatic Fish Line and developed one now used by the Electrical Industry . . . so it can develop other products for which there is a genuine need. Have you a problem that Cope, with its 60 years of experience, can help solve?

The performance of the Cope Pneumatic Fish Line has been truly outstanding, even in the extremely long duct runs recently installed for power service in the United States, Canada, and Brazil.

You too will be able to fish underground ducts—regardless of diameter or length—in a matter of minutes instead of hours.

WRITE TODAY FOR FULL DETAILS OF THE COPE PNEUMATIC FISH LINE.

YOU KNOW COPE BY THESE PRODUCTS

T.J. Cope INC.

711 So. 50th Street, Phila. 43, Pa.

angles of shielding, including 25 and 35 deg. Construction is steel finished with white baked enamel. Louvers can be swung down or removed.

•

Cable Puller

DESIGNED to pull or lift at any angle, the Jiffy lift hoist and puller is manufactured by Jasper Blackburn Products Corp, St. Louis 6, Mo. Housing and lever are aluminum alloy; hooks are forged steel while sprocket is alloy steel. Some applications are pulling cable and messenger wire; also tightening guy wires.

The device has sprocket-type action and single control for up and down motion. With a mechanical advantage of 30:1, the capacity is stated to be 1500 lb. The complete hoist weighs approximately 12 lb, has an overall lever length of 22⅛ in., and produces a standard lift of 55 in.

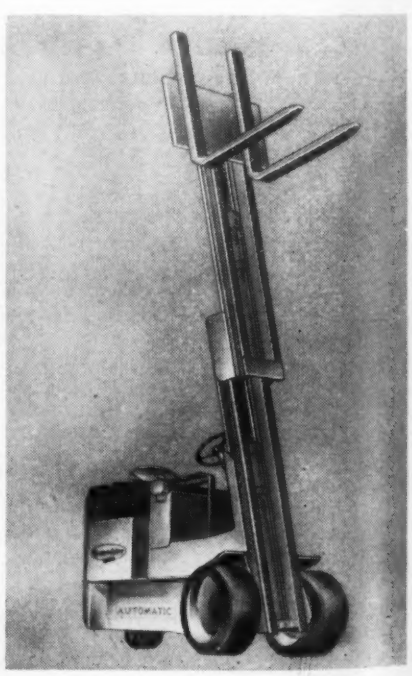
•

Electric Fork Truck

THE TRANSRIDER, a smaller version of the battery operated Skylift truck, has been designed by Automatic Transportation Co, 8 South Dearborn St, Chicago 3, Ill.

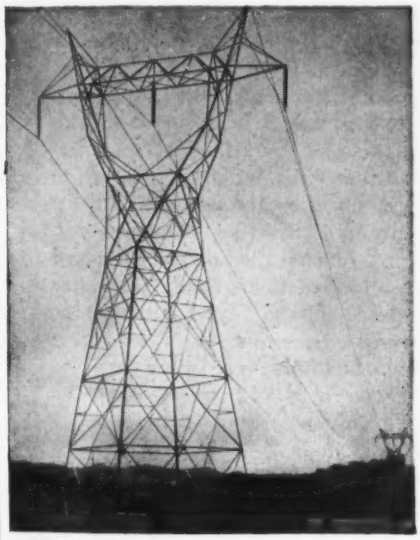
Having an overall height of 83 in. for clearance through standard boxcar and factory doors, the truck can raise a load to a maximum of 130 in. with telescopic extension or 66 in. without extension. Reported capacity of the lift is 2,000 lb with 48-in. load; 2,500 lb with 36-in. load; 2,850 lb with 30-in. load; and 3,000 lb with 28-in. load.

Equipped with two batteries, this vehicle weighs about 4,000 lb complete.

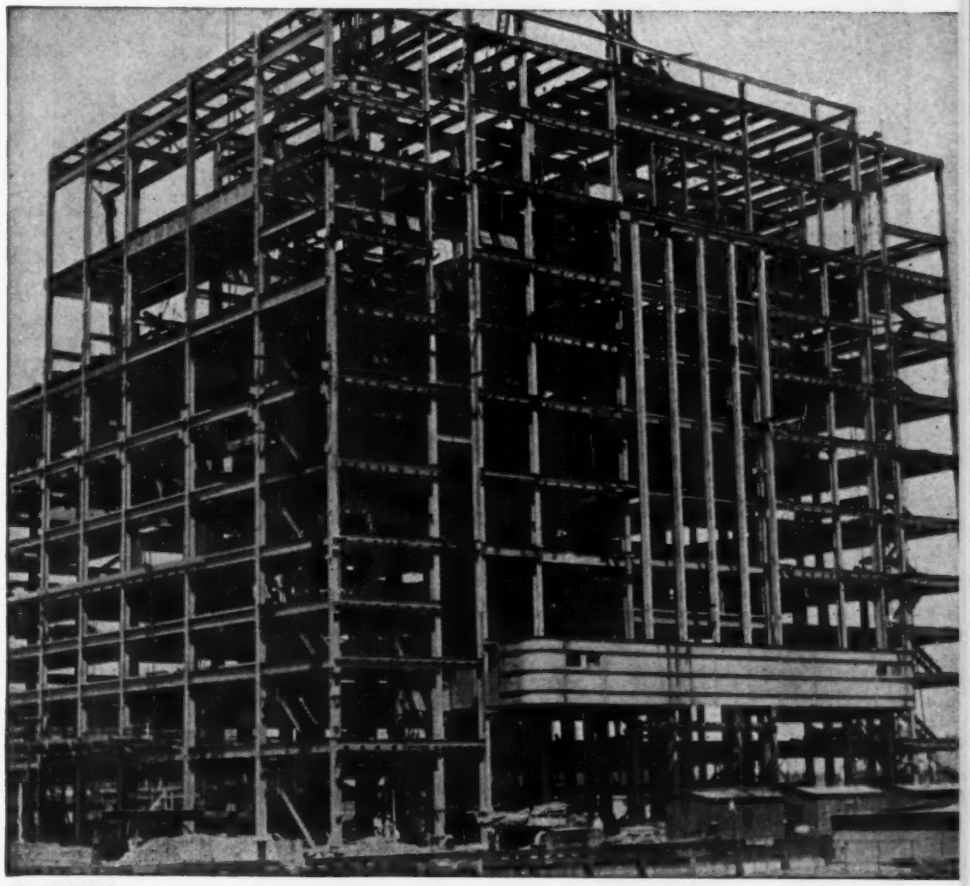


When it comes to power construction let American Bridge **carry the load!**

FOR FASTER, more economical erection of power houses, call on American Bridge. We have the modern equipment and experienced personnel to do the job right. In addition, our facilities for fabricating and erecting power houses, substations and transmission towers enable us to give you—in one "package" — a complete, coordinated service all along the line. On your next job, take advantage of American Bridge Company's unexcelled resources in equipment, in experience, and in technically trained personnel.



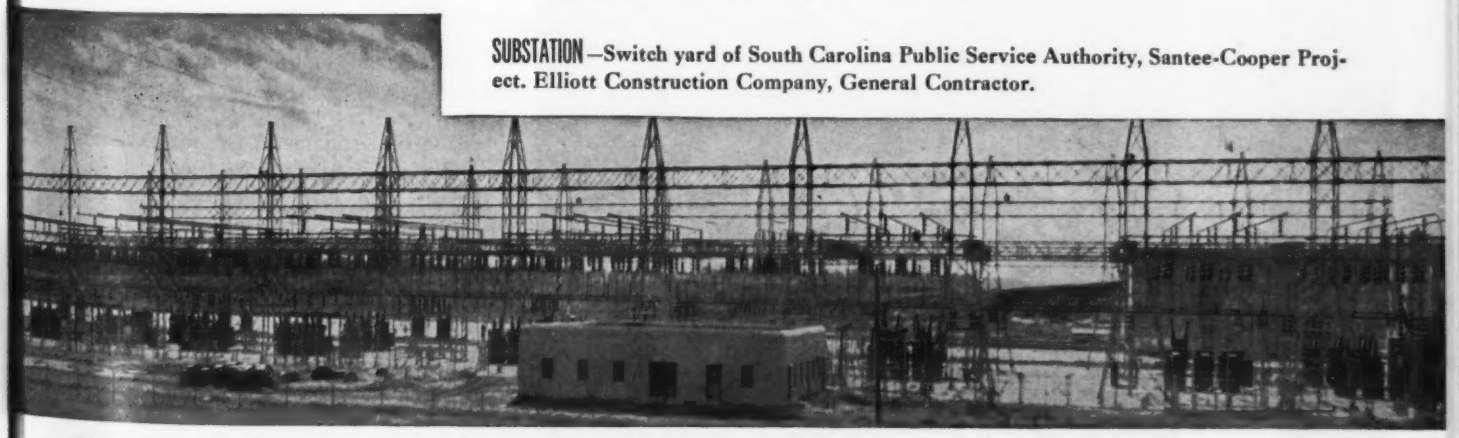
TRANSMISSION TOWER—An American Bridge Company rotated-type single circuit 220 KV suspension tower.



POWER HOUSE—Southwark Power Station of Philadelphia Electric Company. American Bridge Company fabricated and erected the Power House, Maintenance Shop, Boiler House, Electric and Heater Bay, Turbine Room, Switch House, Administration Building, Turbine Supports and Coal Handling Structures.

Weight of structural steel—11,850 tons.

SUBSTATION—Switch yard of South Carolina Public Service Authority, Santee-Cooper Project. Elliott Construction Company, General Contractor.



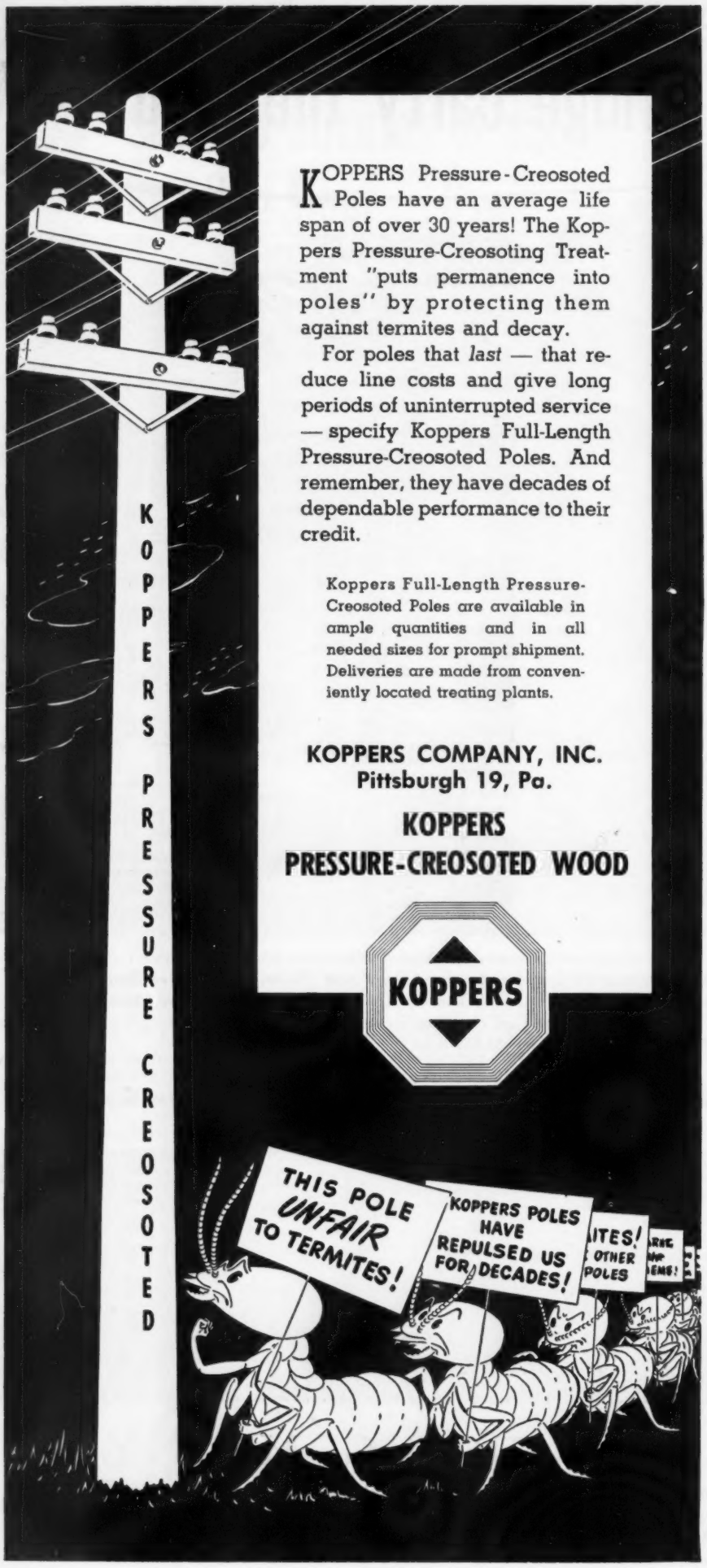
AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Contracting Offices in: Baltimore · Boston · Chicago · Cincinnati · Cleveland · Denver · Detroit
Duluth · Minneapolis · New York · Philadelphia · St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL


KOPPERS PRESSURE CREOSOTED
KOPPERS Pressure-Creosoted Poles have an average life span of over 30 years! The Koppers Pressure-Creosoting Treatment "puts permanence into poles" by protecting them against termites and decay.
For poles that *last* — that reduce line costs and give long periods of uninterrupted service — specify Koppers Full-Length Pressure-Creosoted Poles. And remember, they have decades of dependable performance to their credit.
Koppers Full-Length Pressure-Creosoted Poles are available in ample quantities and in all needed sizes for prompt shipment. Deliveries are made from conveniently located treating plants.
KOPPERS COMPANY, INC.
Pittsburgh 19, Pa.
KOPPERS
PRESSURE-CREOSOTED WOOD
KOPPERS
THIS POLE UNFAIR TO TERMITES!
KOPPERS POLES HAVE REPULSED US FOR DECADES!
OTHER POLES

With an overall length of 97¾ in., including 36-in. forks, the truck can make a right angle turn in 71⅝ in. plus length of load. It has three speeds both forward or reverse and a tilt of ten deg backwards and five deg forward.

MORE NEW PRODUCTS
about which you should know

Ward Leonard Electric Co, Mount Vernon, N. Y. has available Bulletin 4112 Size 2 magnetic **starters** in a maximum enclosed rating 25 hp, 440-550 v, 3 phase, 60 cycles. . . . Soldering Specialties, Summit, N. J., introduced a No. 50 **solder alloy,** an indium-lead alloy (no tin) with a 600 F melting point. . . . Skybryte Co, 3115 Perkins Ave, Cleveland 14, Ohio, has **cleaning crystals** to make a solution for cleaning street lighting globes, glass, reflectors and porcelain.

General Electric Co, Special Products Div, Schenectady 5, N. Y. announced an automatic photoelectric integrating **exposure meter** for intervals of 3 sec to 60 min, operates between 50 and 400 ft-c and on 45-w, 115-v, 50-60-cycle circuit. . . . Lincoln Electric Co, Cleveland 1, Ohio, added to its hard facing line two new tubular type shielded-arc **electrodes:** Faceweld No. 1 deposits a chromium-carbide type alloy surface; and Faceweld No. 12 is used where the surface must withstand severe abrasion as well as impact.

Leece-Neville Co, 53rd and Hamilton Ave, Cleveland 14, Ohio, manufactures an **a-c system** consisting of an alternator, rectifier and regulator in ratings 45 and 80 amp, 6 v, for use on automotive vehicles. . . . Farrelloy Co, 1245 North 26th St, Philadelphia 21, Pa., developed a **liquid flux** for soldering dissimilar metals such as aluminum and stainless steel. . . . Kennametal Inc, Latrobe, Pa., has a line of **bushings** made of Kennametal Grade K6, in 12 OD sizes ranging from ⅜ to 1 in.; length and inside diameter made to customers' specifications.

Industrial Engineering & Equipment Co, 711 South Theresa Ave, St. Louis 3, Mo. has a line of industrial **oil preheaters,** 4.8 to 132 gph, 600 to 16,500 w for commercial voltages. . . . Thomas Associates, 4607 Alger St, Los Angeles 26, Calif., produces a **metal clamp** in sizes from ¼ to 4 in. with a V-shaped rubber wedge and bolt lug to carry wires in loose bundles. . . . Cal-Perry Corp, 62 Franklin St, East Orange, N. J. developed a **soldering tip** for electric soldering guns, made of chromium plated copper; heats in nine sec.

Which Properties Do You Need Most in Electrical Contacts?

IN theory, the perfect contact material should combine non-sticking properties, low contact resistance, high thermal and electrical conductivity and resistance to electrical erosion with high strength and hardness. In actual practice (because operating conditions differ widely) only two or more of these properties usually predominate.

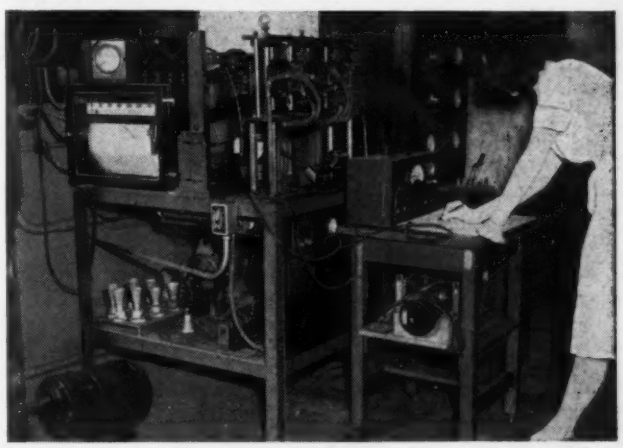
How does Mallory produce materials in which the correct properties for a specific job exist? You can be sure it isn't done by guesswork. Although Mallory has designed more than 5000 different contacts—has had 20 years of experience in metallurgy generally—it believes in rigid control. This control is accomplished by a series of spectrographic, chemical, electrical and microscopic tests such as you see at the right. They reveal the truth about chemical composition, grain structure, physical properties.

MALLORY STANDARDIZED CONTACTS

Yes, you're sure when you order Mallory contacts. Furthermore, you get the benefit of Mallory design experience, its manufacturing facilities for producing every kind of contact including contact assemblies. What's more, Mallory has developed eight basic contact designs that meet thousands of typical applications—save time and money involved in designing "specials." Send for the Mallory Contact Catalog.

This Mallory spectrograph determines the purity and composition of metals and alloys.

Here Mallory learns what happens in the electrical circuit when contacts are opened and closed.



With this unit, Mallory technicians measure contact resistance, temperature rise, and rate of wear.

IT'S 5000 TO 1 THAT A MALLORY STANDARD CONTACT WILL MEET YOUR "SPECIAL" REQUIREMENTS

In Canada, made and sold by Johnson, Matthey & Mallory Limited, 110 Industry Street, Toronto 15, Ontario, Canada

P.R. MALLORY & CO. Inc.

MALLORY ELECTRICAL CONTACTS & CONTACT ASSEMBLIES

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

NEWS ABOUT PEOPLE

B. W. Clark, Westinghouse, Elected NEMA President

B. W. Clark, vice-president in charge of sales for the Westinghouse Electric Corp, Pittsburgh, Pa., was elected president of the National Electrical Manufacturers Association at the annual

B. W. CLARK

meeting held last week in Atlantic City. He succeeds W. C. Johnson, executive vice-president of Allis-Chalmers.

Electrical wholesaling and merchandising have been the chief interests in his business career, which covers a period of more than 41 years. In 1906 he joined the Robertson-Cataract Electric Co at Buffalo, N. Y. He became a special representative of the Westinghouse Supply Co in 1925, and four years later was made general manager. In 1932 he was made vice-president and director, subsequently being elected president of the supply company.

Mr Clark was elected vice-president of the Westinghouse Electric Corp in 1941, heading the company's merchandising activities at Mansfield, Ohio. The next year he was appointed vice-president in charge of sales and, in addition to supervising the sale of electrical apparatus, was made responsible for coordinating all sales activities of the corporation and its subsidiaries. He moved his headquarters from Mansfield to the company's home office in Pittsburgh with this latter appointment.

•

▶ D. Bruce Mansfield, partner in the law firm of Amerman, Mills, Mills, Jones & Mansfield of Canton, Ohio, has been named general counsel of Ohio Edison Co, Akron. Mr Mansfield taught finance and corporation law at Temple University and law at the University of California. He spent two years as a senior attorney with the public utilities division of the Securities and Exchange Commission. He has been associated with the Canton law firm for the past seven years.

▶ James F. Fairman, vice-president of Consolidated Edison Co of New York, has been elected vice-president of the United Engineering Trustees, Inc, New York.

▶ Charles T. Evans, for several years assistant to President C. H. Moses of the Arkansas Power & Light Co, Little Rock, has been elected a vice-president of the company.

▶ Rob Roy MacLeod, vice-president of the Buffalo Niagara Electric Corp, has been appointed chairman of the state and national affairs committee of the Buffalo Chamber of Commerce.

Gnuse Made Engineering V-P, Nantahala Power Co

H. H. Gnuse, Jr, has been appointed vice-president in charge of engineering for the Nantahala Power & Light Co,

H. H. GNUSE, JR

Franklin, N. C. Mr Gnuse became identified with Nantahala Power in 1940 as assistant electrical engineer, supervising the electrical installations on the

TESTIMONIAL of friendships made during an active business career was the Appreciation Dinner given at the Nicollet Hotel, Minneapolis, to H. E. (Cy) Young, recently retired vice-president of Northern States Power Co. More than 250 of his associates in business and civic affairs paid tribute to his contributions in developing industry and commerce throughout the Upper Midwest. Governor Luther Youngdahl is shown presenting a bronze plaque

KEY FEATURES OF A COMPLETE STEEL SERVICE

Some types still short, but over-all stocks in 13 Ryerson plants are probably the nation's largest.

Prompt personal steel service on all orders, large or small, is a Ryerson tradition.

Accurate cutting to your order is assured by modern Ryerson equipment.

Over a Century of steel experience means more know-how applied to your steel problems.

You get quick delivery anywhere, because the network of Ryerson plants stretches from coast to coast.

PRINCIPAL PRODUCTS

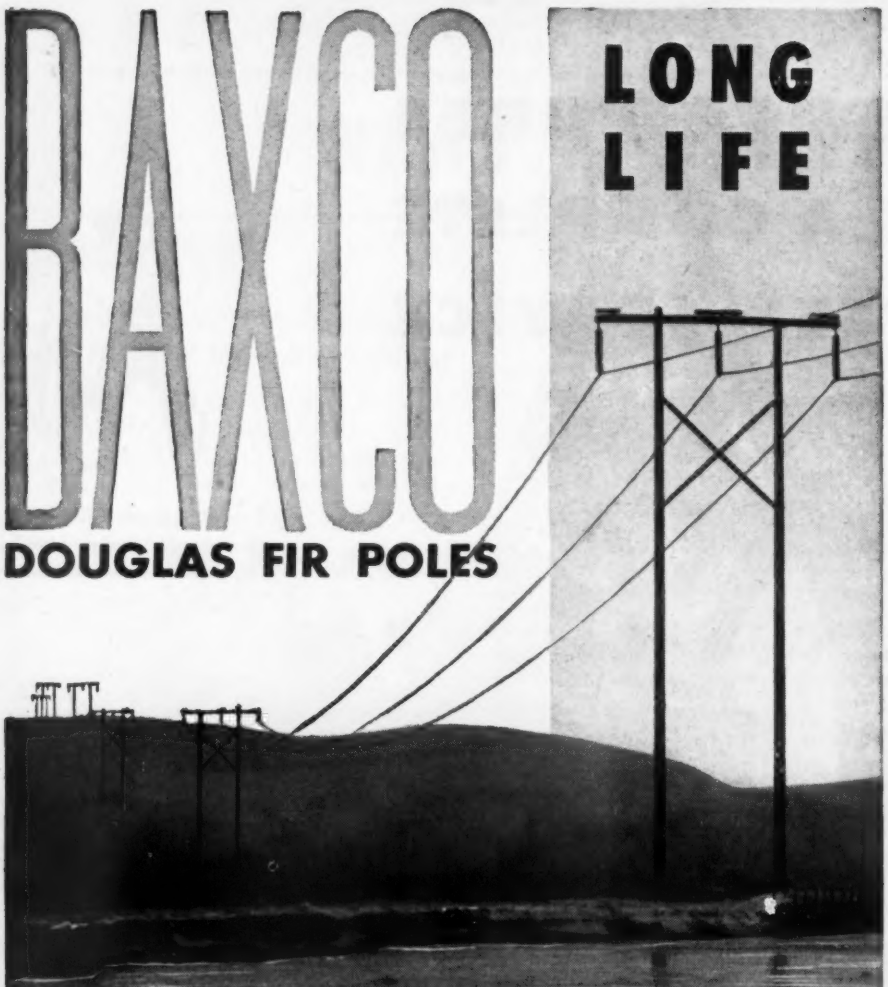
BARS—carbon & alloy, hot rolled & cold finished
STRUCTURALS—channels, angles, I & H beams, etc.
PLATES—sheared & U. M., Inland 4-Way Floor Plate, etc.
SHEETS—hot & cold rolled, many types & coatings
TUBING—seamless & welded, mechanical & boiler tubes
STAINLESS—Allegheny metal sheets, plates, bars, tubes, pipe, etc.
REINFORCING—bars & accessories, wire mesh, etc.
BABBITT—and phenolic laminated bearing material
MACHINERY & TOOLS—metal working & boiler shop

Added Ryerson service includes a chart to guide heat treating sent with alloy shipments.

RYERSON STEEL

Joseph T. Ryerson & Son, Inc. Plants: New York • Boston • Philadelphia • Detroit • Cincinnati Cleveland • Pittsburgh • Buffalo • Chicago • Milwaukee • St. Louis • Los Angeles • San Francisco

BAXCO
LONG LIFE
DOUGLAS FIR POLES



Our specialty is long-length Douglas Fir poles, pressure treated for Long-Life service. Prompt shipments of reasonable quantities can now be made in most lengths from 60 foot to 125 foot. Direct rail shipments out of our treating plant stocks can be made to any point in the United States. Write or wire us your inquiries.

Pressure treated Douglas Fir poles have been for years the standard in pole line construction on the West Coast. BAXCO Long-Life Douglas Fir poles meet ASA Specifications and are pressure treated with coal-tar creosote or creosote-pentachlorphenol solution by the empty cell process, 8-lb. retention, in accordance with AWPA Specifications.

BAXCO Long-Life Douglas Fir poles, pressure treated from high quality Coast-type timber, will cut your maintenance costs and yield longer and more satisfactory service.

Also Produced by J. H. Baxter & Co. of Oregon—*an associated company*
Plant and Yard—Eugene, Oregon

J. H. Baxter & Co.

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LOS ANGELES · LONG BEACH · ALAMEDA · CALIFORNIA, U. S. A.

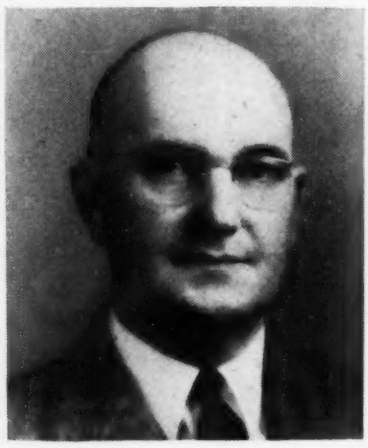
Glenville and Nantahala developments. In 1942 he was made electrical engineer in charge of the operation and maintenance of the generation and distribution systems, the position he held until his recent promotion.

Earlier in his career he was identified with the Tennessee Valley Authority, where his work involved computation and layout as senior draftsman in the electrical design department; field and office cost studies as junior and assistant cost engineer; and installation, inspection, and testing work on the Guntersville, Chicamauga, and Wheeler projects as junior and assistant electrical engineer.

•

M. A. King Rejoins Elliott As V-P, Engineering

M. A. King, formerly manager of engineering, has rejoined the Elliott Co, Jeannette, Pa., as engineering vice-president, Jeannette division. Mr King, who had previously been with Elliott for 27 years, was executive engineer for the turbine division of Worthington Pump & Machinery Corp for the past five years.



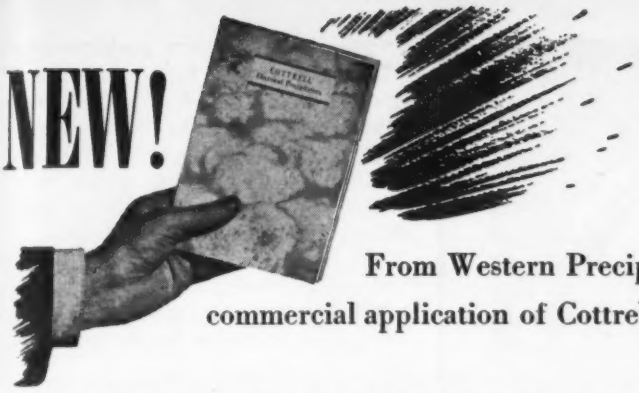
M. A. KING

He became identified with the Kerr Turbine Co of Wellsville, N. Y., in 1916. Elliott purchased the Kerr Turbine Co in 1923 and made Mr King its chief engineer in 1924. He moved to Jeannette with the turbine department in 1927 and became turbine manager in 1932. In 1941 he was appointed manager of engineering for the company.

•

► F. J. Hood has been elected president of Ansul Chemical Co, Marinette, Wis. He succeeds Harvey V. Higley, who has been named chairman of the board of directors. Mr. Hood joined Ansul's California office in 1928. He engaged in sales work for eight years, returning to Marinette in 1936. In 1938 he was elected secretary and treasurer of the company. He was made vice-president

NEW!



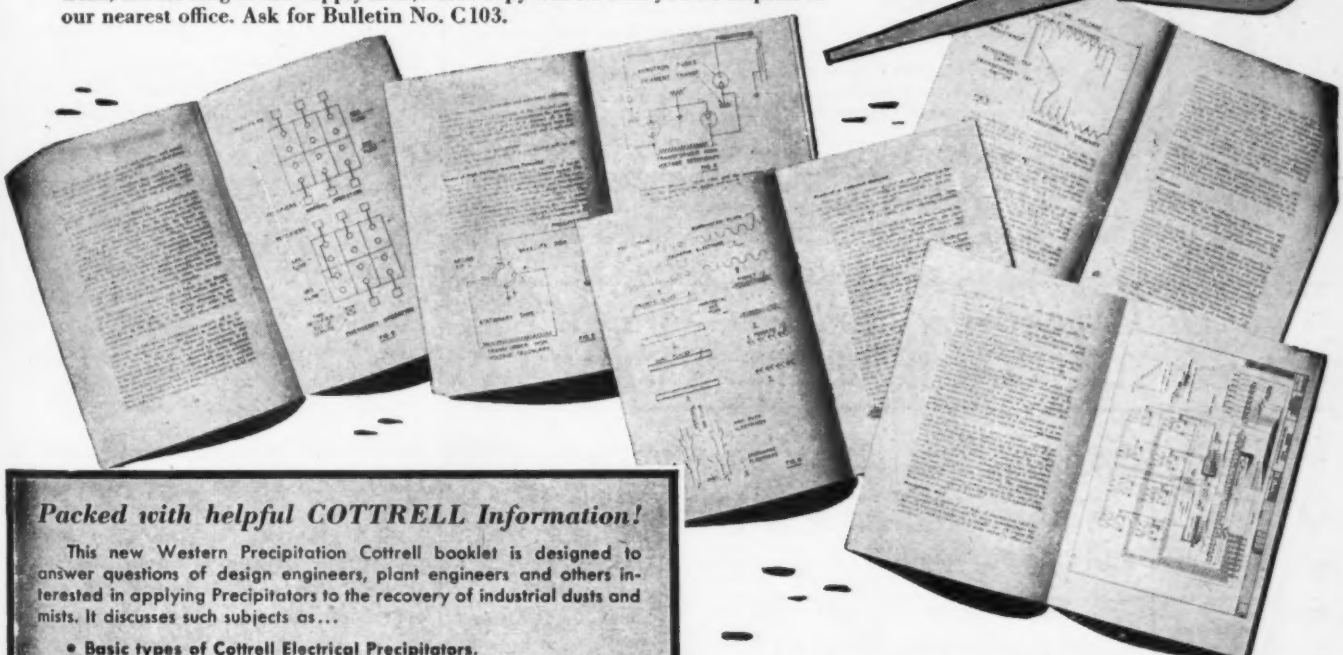
From Western Precipitation—the organization that pioneered the commercial application of Cottrell Precipitation...

IF YOU ARE ENGAGED in any phase of industry where the recovery of dusts, fumes, fly ash, mists, fogs or other suspensions from gases is a problem, you will find this new booklet on the COTTRELL Electrical Precipitator helpful and informative.

Western Precipitation pioneered and installed the first commercial application of the well-known COTTRELL Electric Precipitator—Dr. Cottrell, the inventor, being a member of the company. And for more than 38 years Western Precipitation has consistently led in developing new COTTRELL advancements and techniques for recovering suspensions from gases, both wet and dry.

This new 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C103.

28 PAGES
of helpful facts to know about
COTTRELL ELECTRICAL PRECIPITATORS



Packed with helpful COTTRELL Information!

This new Western Precipitation Cottrell booklet is designed to answer questions of design engineers, plant engineers and others interested in applying Precipitators to the recovery of industrial dusts and mists. It discusses such subjects as...

- **Basic types of Cottrell Electrical Precipitators.**
- **Principal parts of a Cottrell Precipitator.**
- **Mechanical and Electronic Rectifiers.**
- **Various types of Collecting Electrodes (rod curtains, corrugated plates, dual plates, pocket electrodes, etc.).**
- **Removal of Collected Material.**
- **Factors in Shell Construction (steel, concrete, brick, etc.).**
- **Operating Efficiencies and the Effect of Various Factors on Performance.**

...and many other basic Cottrell facts. Write for your free copy of Bulletin C103 today while supplies are adequate!

Western Precipitation is not affiliated with any other company in the field of electrical precipitation except its wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. Whether you are now contemplating the installation of a Cottrell Electrical Precipitator, or may be interested in such an installation at a future date, we can and will serve you in any part of the United States or other countries.

NOW SELLING...

COTTRELL Precipitators
MULTICLONE Collectors
TURBULAIRE Spray Dryers

...in all parts of the U. S. A. and foreign countries.

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

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Fuses, faulty in design, and poor clip contact are causing thousands of shut-downs . . . TRICO "Powder-Packed" Renewable Fuses are engineered to give maximum efficiency, safety & dependability.

TRICO "KLIPLOK" Clamps *"Lock Like A Vise"* and literally bolt the fuse & clips together, supplying the important pressure for easy flow of current.

TRICO FUSES Give:

- Three Times The Service.
- Tamper-proof Protection.
- Low-resistance Contacts.
- Safe Time-lag.
- Link Protection & support.
- Life-time Outer Parts.

"KLIPLOK" CLAMPS Reduce:

- Premature Fuse Blowings.
- Unnecessary Shut-downs.
- Lost Production.
- Unnecessary Repairs.
- Wasted Kilowatts.
- Doubling-up Fuse Links.
- Fire & Accident Hazards.

WRITE FOR BUL. 1 & 6

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In Canada: IRVING SMITH LIMITED, Montreal

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Acme ELECTRICAL INSULATING VARNISHES

No.	Type	Viscosity cp. @ 77° F.	Non-volatile % (solids content)	Film increase per coat, avg. mils	†Baking Range, conventional or infared	Solvent	Applications
*145	Clear thermosetting	15–20	45	1.5	30 min. to 6 hrs. @ 250°–350° F.	VM & P Naphtha	Coil windings of all types. Armatures, stators, fields, transformers, frames, housings, etc. Varnishes adaptable to conventional and conveyorized systems. Apply by: Vacuum impregnation Dipping Brushing Spraying
1451	Clear thermosetting	40–50	45	2.5	18 min. to 4 hrs. @ 250°–350° F.	VM & P Naphtha	
1452	Clear thermosetting	40–50	45	2.0	30 min. to 8 hrs. @ 230°–330° F.	VM & P Naphtha	
1454	Clear thermosetting	70–100	45	3.0	12 min. to 2 hrs. @ 250°–350° F.	VM & P Naphtha	
175	Clear thermosetting	300–500	75	5.0	35 min. to 8 hrs. @ 250°–350° F.	VM & P Naphtha	
245	Black thermosetting	140–160	45	3.0	20 min. to 6 hrs. @ 250°–350° F.	VM & P Naphtha	
300	Clear air drying	40–50	45	2.5	8–10 hrs. @ room temp.	VM & P Naphtha	
1457	Clear Baking (Oxidizing-Polymerizing)	35–40	45	2.0	1–8 hrs. @ 275°–330° F.	VM & P Naphtha	
613	Black Baking & finishing	40–50	45	3.5	1 hr. @ 260° F. 2 hrs. air dry	VM & P Naphtha	
707	Clear Spirit	5–10	25	0.8	25 min. air dry room temp.	Denatured Alcohol	

* Also supplied in 60% solids. † Baking conditions determined by equipment available, size and construction of units treated, properties required in cured varnish film, etc.

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in 1945. Mr Hood is a past-president of the Refrigeration Equipment Manufacturers Association. FRANKLIN WEDGE, formerly eastern manager for Ansul Chemical, has been appointed assistant to the president. He has moved from Philadelphia to the company's main office at Marinette.

▶ M. A. CHAPMAN, formerly president, is now president and chairman of the board, Mica Insulator Co, Schenectady.

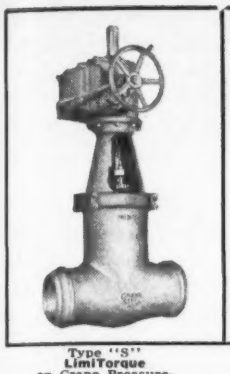
▶ WILLIAM S. EDSALL, formerly president, is now president and general manager of the Chase-Shawmut Co, Newburyport, Mass.

▶ R. S. REYNOLDS, JR., has been elected president of Reynolds Metals Co, Louisville, Ky. He succeeds his father, who continues as chairman of the board. The new president has served as vice-president and treasurer. M. M. CASKIE, a vice-president and director, has been elected executive vice-president, and CALVIN COGHILL, assistant treasurer, was named treasurer. KENNETH MANN, formerly executive vice-president of Tucson Steel Co, Detroit, has been made manufacturing vice-president of Reynolds Metals.

▶ ALBERT S. BROSS has been appointed assistant general sales manager of Landers, Frary & Clark, New Britain, Conn. Mr Bross has held various sales department positions at the company's home offices for a number of years. His new assignment will include activities embracing the several sales divisions, branch offices and field selling staffs.

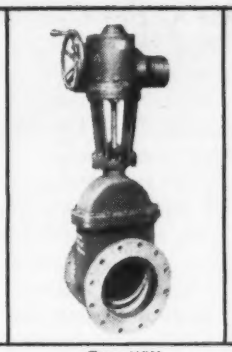
▶ LEWIS W. METZGER, vice-president of the Baldwin Locomotive Works, Philadelphia, has been made executive assistant to Marvin W. Smith, executive vice-president, and will assist Mr Smith in all phases of Baldwin's operating activities. Announcement also was made of the appointments of James R. Weaver as manager of manufacturing, Eddystone Division, and of John S. Newton as manager of engineering, Eddystone Division. Both Mr Weaver and Mr Newton go to Baldwin from the Westinghouse Electric Corp.

▶ EDWIN D. TILLSON, lighting and heating engineer of the testing department of the Commonwealth Edison Co, Chicago, has retired after 33 years of service. Under his direction since 1921, the lighting laboratory expanded its activities to include testing and research in all phases of residential, commercial and industrial illumination, infrared, induction and dielectric heating and the testing of germicidal and therapeutic equipment. Mr Tillson served as chairman of the lighting committee for the Chicago Century of Progress. Tech-



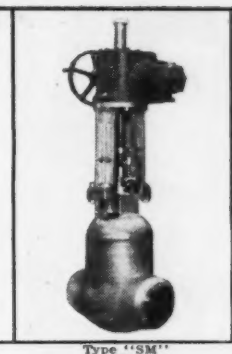
Type "S" **LimiTorque** on Crane Pressure-Seal Valve

Type "M" **LimiTorque** on Jenkins Gate Valve

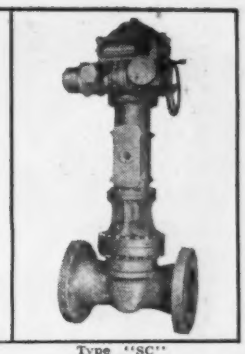


Type "S" **LimiTorque** on Darling Gate Valve

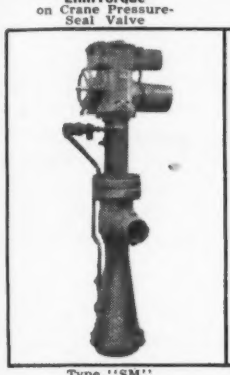
Type "SM" **LimiTorque** on Ludlow Gate Valve



Type "SM" **LimiTorque** on American Chain & Cable Co. (RP&C) Gate Valve



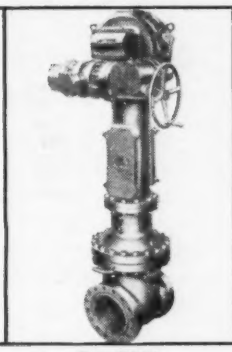
Type "SC" **LimiTorque** on Crane Venturi Gate Valve



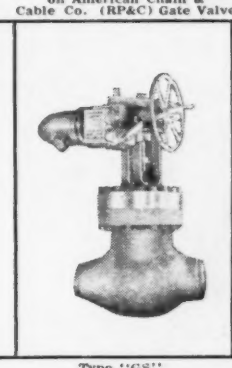
Type "SM" **LimiTorque** on Schutte & Koerting Reducing Valve

Type "SM" **LimiTorque** on Rennselaer Inside Screw Gate Valve

Type "S" **LimiTorque** on Edwards Angle Valve

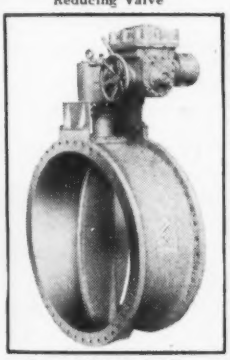


Type "SC" **LimiTorque** on Powell Gate Valve

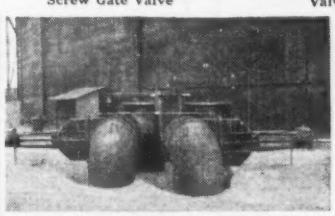


Type "GS" **LimiTorque** on Edwards Boiler Non-Return Valve

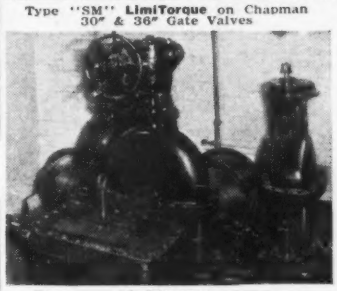
Type "BFM" **LimiTorque** on Phillips (Henry Pratt Co.) Butterfly Valve



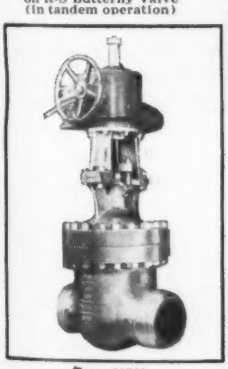
Types "S" & "M" **LimiTorque** on R-S Butterfly Valve (in tandem operation)



Type "SM" **LimiTorque** on Chapman 30" & 36" Gate Valves



Type "M" **LimiTorque** on 24" Iowa Gate Valve



Type "S" **LimiTorque** on Walworth Valve

Limitorque

MOTOR-OPERATED VALVE CONTROLS

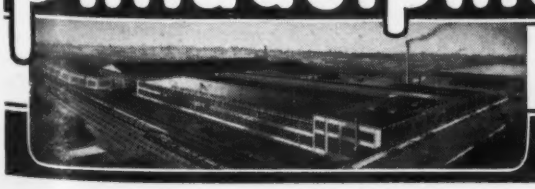
. . . are widely used on many different makes of valves

"*LimiTorque*" operates by the "push of a button," from either remote or nearby control panel . . . prevents damage to stem, seat, disc, gate or plug, because the Torque Seating Switch limits the torque, and thereby, shuts-off the motor, *before* trouble can occur. Thousands are in daily use on land and sea.

LimiTorque Controls may be obtained through Valve Manufacturers.

There's a Reason for Such Widespread Acceptance

Philadelphia Gear Works, INC.



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EARTH
ANCHORS

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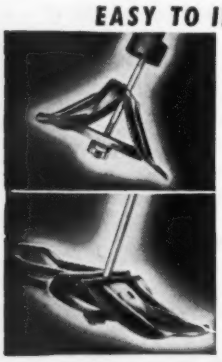
P-L ALL STEEL, EXPANDING TYPE EARTH ANCHORS

Here is the first really efficient, two-piece earth anchor that is of simple, fool-proof, all-steel, heavy-duty construction. P-L Earth Anchors are exceptionally rugged and possess tremendous holding power. P-L Anchors can do a better job and can be installed quicker in all types of soil. Everyone from the engineer to the lineman can appreciate the ease of handling and installation.

EASY TO INSTALL



P-L Anchors come to you as assembled units. Built of two simple pieces of heavy steel plate. A few blows of the tamping bar and the sharp edged blades cut deeply and permanently into solid, undisturbed earth.

FOR LITERATURE WRITE

PIEPER-LILLARD
INCORPORATED
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nical director of the Chicago Lighting Institute since its inception in 1930, he has served for 32 years in the Illuminating Engineering Society as manager, secretary and chairman of the Chicago section, as director of the national society and on many of its technical committees. In 1945 he was elected a fellow of the society. Mr Tillson has also served on committees of the Electric Association of Chicago, the International Commission on Illumination and the Association of Edison Illuminating Companies.

•

General Electric Makes Engineering Appointments

George R. Prout, vice-president of the General Electric Co and general manager of the air conditioning department, has been named an assistant general manager of the company's nucleonics department. Mr Prout will assume his new position Jan 1, succeeding Roy C. Muir, GE vice-president, who returned from retirement last April to head the department. Mr Muir will continue as a consultant.

Harold F. Smiddy was named general manager of the air conditioning department, effective Nov 1, but will continue in his present position of general manager of the chemical department. Mr Prout's headquarters will be at the Hanford atomic energy works, which the company operates for the Atomic Energy Commission near Richland, Wash. Mr Smiddy will have headquarters both at Bloomfield, N. J., and Pittsfield, Mass. Robert S. Neblett, assistant general manager, who has been stationed at Hanford, will make his headquarters at Schenectady, where he will be in charge of the nucleonics department activities in that area.

Mr Prout has been associated with the company since 1920 and with the air conditioning department since 1944. Mr Smiddy was appointed general manager of the chemical department in 1948. From 1943 until he joined GE in 1948 he was a partner in Booz, Allen & Hamilton, industrial management consultants. He is well known in the utilities field, having served as a director and head of the operating and sales departments of Ebasco Services, Inc. Earlier, he was an executive of the Electric Bond & Share Co and operating manager of West Penn Power Co.

•

▶ W. N. Goodwin, Jr., has retired after completing 50 years of service with the Weston Electrical Instrument Corp., Newark, N. J. Joining the organization in 1898, Mr Goodwin was appointed chief engineer and director of research in 1906 and was eventually elected vice-president in charge of research and engineering. His fundamental engineering has been an important factor in nearly every major Weston contribution to electrical measurement. Although officially retired, he still served Weston as a consultant.

▶ F. L. Lawton, formerly assistant chief engineer with Aluminum Co of Canada, Limited, has been appointed head of the newly formed power department of Aluminum Laboratories Limited. Mr Lawton is well known in North American engineering circles, having been closely associated with the wartime expansion of power and other plant facilities of the Aluminum Co, especially Shipshaw. He is a former Canadian vice-president of the American Institute of Electrical Engineers and has taken a leading part in Canadian engineering activities in the hydro-electric power field.

▶ C. V. Coons, formerly general sales manager, is now vice-president in charge of sales, Rheem Manufacturing Co, Inc, New York, N. Y. Mr Coons is affiliated with the electric water heater section of the National Electrical Manufacturers Association.

OBITUARY

▶ Harvey K. Brown, 70, for many years general superintendent of the Malden (Mass.) Electric Co, died at Medford, Mass., on Nov 4. He joined the company in 1897, later becoming superintendent of distribution. He retired in 1946.

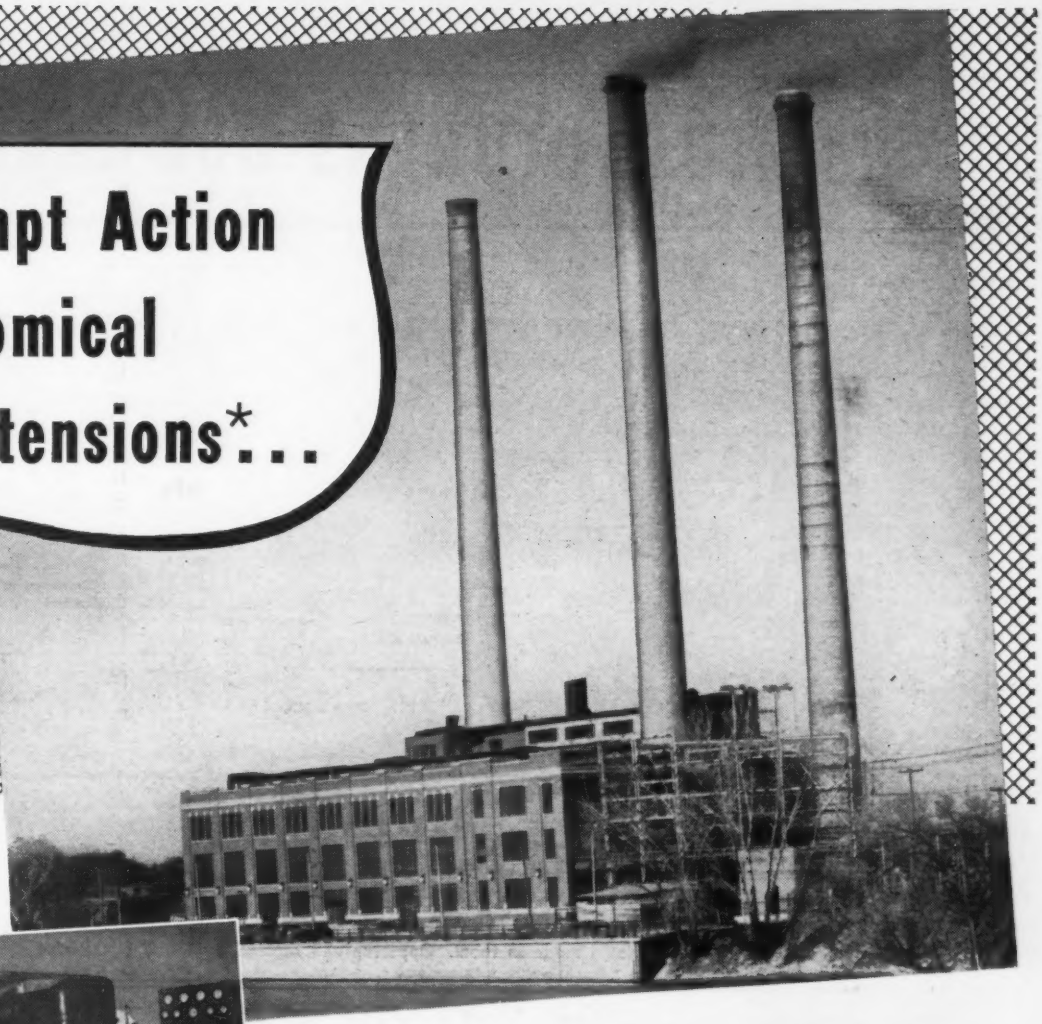
▶ Ford H. Dubs, for several years planning engineer for the distribution system of the Toledo Edison Co, died on Sept 28 in that city after a long illness. He was 55 years old. Mr Dubs became identified with Toledo Edison in 1924 as assistant to the system operator, subsequently becoming system operator.

▶ Emil C. Heintze, 63, retired electrical engineer with Seattle, Wash., City Light, died Sept 30 following a heart attack suffered while on a hunting trip near Medford, Ore. Born in Moorhead, Minn., he was graduated from Washington State College and had lived in Seattle since 1908. He retired in 1943.

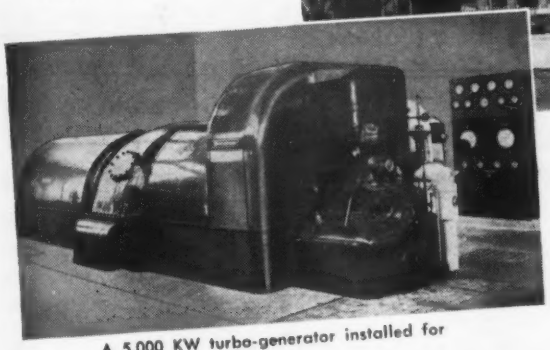
▶ Theodore N. Richards, manager of the Central New York Power Corp at Massena, N. Y., for more than 34 years, died suddenly at his home in that city on Oct 29. He was 61 years old.

▶ Clarence H. Coe, 65, division manager for the Mountain States Power Co at Coos Bay, Ore., died on Oct 27. Mr Coe formerly served as Mountain States Power Co manager at Tillamook, Ore.

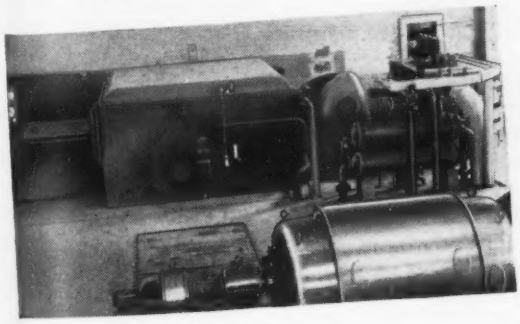
For Prompt Action on Economical Plant Extensions*...



To the plant of a large midwestern utility, shown at right, Pritchard added a 10,000 KW turbo-generator.



A 5,000 KW turbo-generator installed for a southwestern utility.



A 7,500 KW turbo-generator added to a western plant.

Consult PRITCHARD

Pritchard's extensive experience with plant expansion work assures prompt and economical design, engineering and installation for your own project.

**Examples of such installations that were developed in their entirety by J. F. Pritchard & Co., are shown above and at the left.*

Expressly devoted to corporate utilities and industrial users of electric power and steam, the services of the Power Division of J. F. Pritchard & Co. are available to you immediately. If you are planning either complete new stations, additions or alterations that must produce power at a profit, consult Pritchard NOW!

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FIVE FIELDS — Serving the CHEMICAL, POWER, PETROLEUM and GAS industries as well as providing specialized EQUIPMENT for all industries.

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MANUFACTURERS and MARKETS

SALES MEETING of Murray Manufacturing Corp held recently in Brooklyn gave sales force a chance to get a thorough grounding in company's products and latest developments made in them. Opportunities offered by the expansion of electric utilities were also stressed

Lightning-Operation Data Compiled by Ohio Brass

Data on the lightning performance of typical high voltage transmission lines throughout the world have been compiled in a book by the Ohio Brass Co. Statistics in the volume were obtained from a survey by the company in 1947 and 1948 and embrace 54 complete lightning reports on 74 different lines owned by 44 power companies.

The book offers no interpretation of the facts and draws no conclusion from the data. However, a reader is likely to draw at least four conclusions:

1. Transmission lines operating in the United States have generally better lightning performance—average lightning outages per 100 miles per year—than similar lines in foreign countries for which data are given.

2. While outages per 100 miles for individual lines in the U. S. range as high as 12, the average for all lines in the U. S. falls between 2 and 3.

3. Lines on which the shielding angle of overhead ground wires is large usually have higher than average outage rates. However, not all lines with above average outage rates have large shielding angles.

4. Tower top configuration of lines of the same preferred nominal voltage rating vary widely. Literally there are almost no two lines alike.

Lines for which data are given are grouped in six classifications according to preferred nominal system voltage. These groups are 69, 115, 138, 161, 230 and 287.5 kv.

The following data are given on each line: Company name, location of line, voltage, length, years of operation, general direction, terrain, annual storm days, conductor, ground wire, mid-span separation, suspension insulators, normal tangent span length, arcing horns or rings, tower footing resistance, counterpoise, type of system, impulse insulation, normal total time to clear ground fault, ground fault neutralizer or protector tubes, arcing damage to insulators or conductors, average annual lightning outages, average annual lightning outage per 100 miles.

•

Opens New Tulsa Office

Cutler-Hammer, Inc, Milwaukee, has opened a new branch sales office at 533 Mayo Building, Tulsa, Okla. B. R. Stratton will manage the new office as a branch of the company's Dallas district sales office.

Must Spend $16 Billion to Meet Power Demands

Public utility companies in the United States will have to spend about $16,000,000,000 in the next ten years, for new and improved generating and distribution facilities, according to a prediction made by Tomlinson Fort, manager of central station sales for the Westinghouse Electric Corp in a recent address at Pennsylvania State College.

Production of electric power in this country must be increased from slightly over 250 billion kwhr to 430 billion kwhr to supply a demand that will nearly double within the next decade. An expansion of the generating capacity of this country from 52 to over 95 million kw will be required to produce this power. In money this means that the electric power business of the United States probably will have to double its investment over a period of the next ten years.

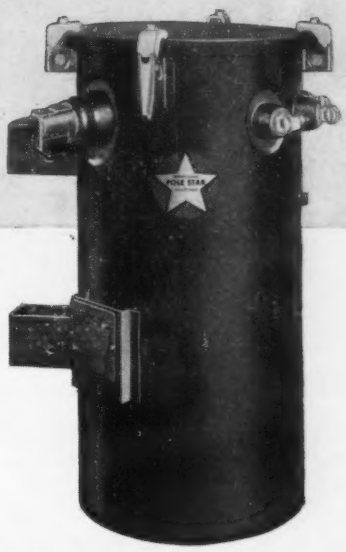
A recently completed Westinghouse survey of the outlook for the electric power industry indicates that residential use of electricity in this country will increase in the next ten years from an average of 1,438 kwhr per home to 2,400 kwhr.

More than 6,000,000 new customers

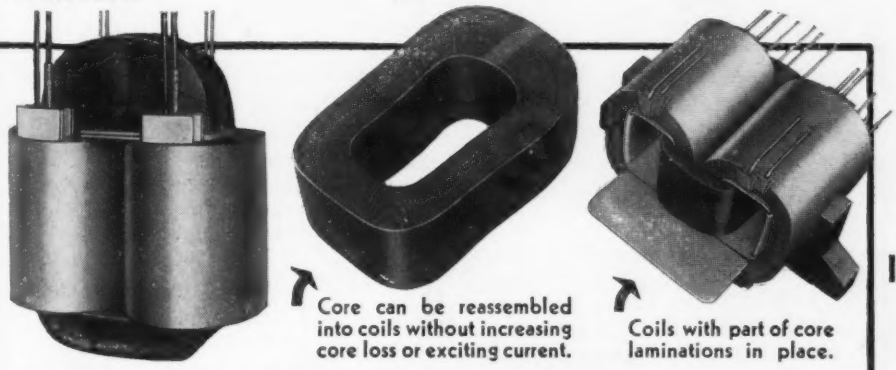
"Hold it, Bill!.."

we never scrap any POLE STAR* Core and Coil units. It's much more economical to repair or replace a damaged coil."

That's right, George! It's a simple matter to remove the POLE STAR core from the coils and then reassemble the entire unit. No special tools are needed, and what is more, the core can be restacked without fear of encountering high core loss or high exciting current. The POLE STAR core is designed and constructed in such a manner that the annealed steel need not be bent beyond its elastic limits. This outstanding construction feature of Pennsylvania's POLE STAR Transformer enables a coil to be quickly and cheaply replaced if it is damaged by lightning or by being too heavily overloaded.



Embodying a new wound core design with an inherent low exciting current, POLE STAR Transformers are made in sizes 25 Kva and below, 14400 volts and below, single phase, 60 cycles, OISC, conforming to EEI-NEMA Standards.



Core can be reassembled into coils without increasing core loss or exciting current.

Coils with part of core laminations in place.

LAMINATIONS INDIVIDUALLY LAPPED . . . .

Each lamination forms its own flux path. No flux has to cross from one turn to the next. Where the two ends of individual laminations come together, they are overlapped. This 100% additional cross-section at the lap reduces the density and prevents a concentration of flux.

*P.S.

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Safe Thrifty And Reliable

Pennsylvania TRANSFORMER COMPANY

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FIBERGLAS TREATED TUBINGS ARE MADE TO EXACT SPECIFICATIONS

National Fiberglas tubings are woven and treated in the National plant, on automatic machines which place each thread under precisely controlled tension and impregnate each strand to exactly the desired degree.

Thus the Fiberglas base *invariably* delivers the maximum in resistance to heat and corrosion damage, and precision impregnation insures strict uniformity of performance.

National treatments range from light to heavy saturated with conventional or silicone varnish. All standard sizes are available promptly from stock.

Send for our treated tubing sample folder. And keep in mind — when you specify National Treated Tubing you specify dependability

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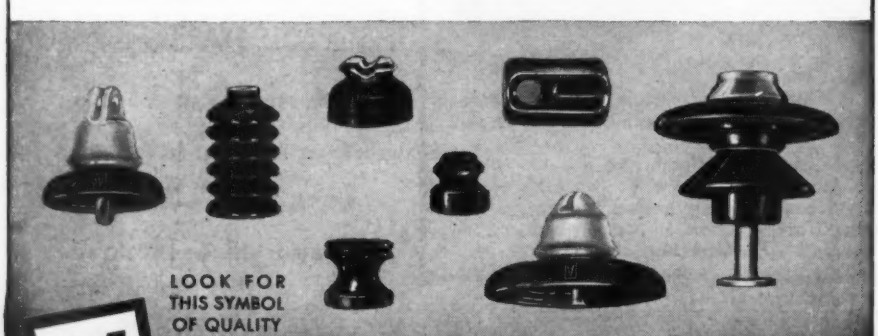
COLUMBUS 16, OHIO, U. S. A.
ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION — REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES
TRADE MARK

ANOTHER STEP IN THE PROGRESS AND GROWTH OF VICTOR...OUR NEW, MODERN KILN NO. 3...

For DEPENDABLE Insulators Specify VICTOR

HIGH tension porcelain insulators made at Victor have passed the most *severe* tests on countless types of installations during the past 50 years. For safety, service and satisfaction, specify "Victor." We are doing our utmost to maintain dependable deliveries.



LOOK FOR THIS SYMBOL OF QUALITY

V

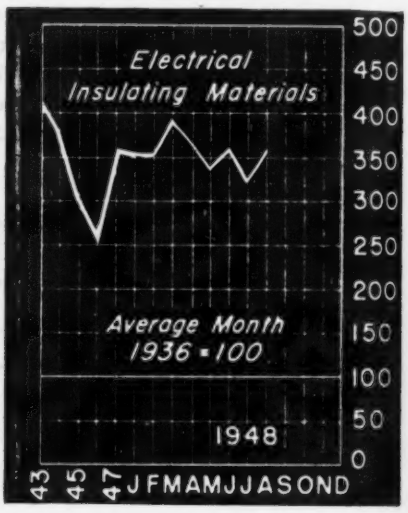
VICTOR INSULATORS, Inc., Victor, N.Y.
BIRTHPLACE OF FIRST WET PROCESS HIGH-VOLTAGE INSULATORS

have been added to utility systems since the war ended. More than 4,000,000 farms now are connected to distribution lines, and in the next five years this number will reach 5,000,000, or 90% of all occupied farms.

•

Insulating Materials Sales Increase 10% in August

Sales billed on electrical insulating materials during the month of August, 1948, moved upward, according to



figures released by the National Electrical Manufacturers Association. The index advanced to 354 from 323 in July, an increase of 10%.

In August, 1947, the index stood at 320, this year's figure representing an increase of 11%.

•

"Steam for Power" Film

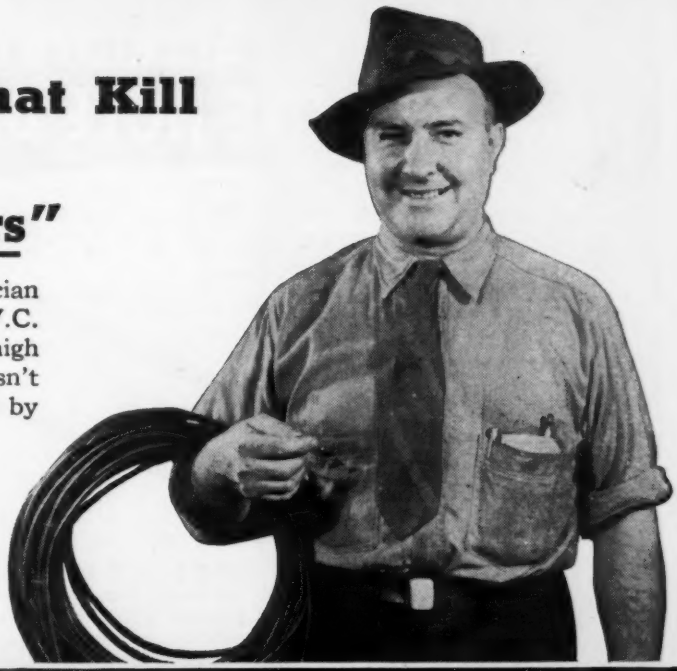
Announcement has been made by the Babcock & Wilcox Co, New York, of the release of a new 16-mm educational film, "Steam for Power," which depicts the development and application of modern steam boilers. The sound-color film has a running time of 41 minutes. It will be available on Dec 1, 1948, free of charge, to engineering and other professional societies, engineering schools, civic organizations, and groups interested in power generation and utilization. Written requests should be made to the Advertising Division, Babcock & Wilcox Co, 85 Liberty St, New York 6.

•

Electrical Company Moves

Change of address for the general offices of the United Manufacturing & Service Co of Milwaukee, Wis., has been announced by Halbert W. Hoard, president. This move consolidates the offices and the enlarged plant at 405 South Sixth St, Milwaukee 4.

"Under Conditions That Kill Ordinary Wire Fast, This Wire Lasts Years"



Says Mr. T. F. Bannon (right) Chief Electrician at Bird & Son, "Rockbestos 600 Volt A.V.C. lighting wire withstands the baking heat and high humidity our conditions impose on it. It doesn't bake brittle, crack or flow. It isn't damaged by the constant condensation. In short, it lasts years longer under these rigid conditions than we could hope for with 'ordinary' wire. I've used Rockbestos A.V.C. for over 20 years... and it hasn't ever fallen down on a job for me yet! What electrician could ask for more?"

In the paper plant of Bird & Son, inc., East Walpole, Mass., temperatures in this paper machine dryer hood run a constant 135° to 140° F., with relative humidity often as high as 65%. Conditions like these mean a quick end for lighting wire not specifically engineered to do the toughest jobs as dependably as the easiest ones. Which is why more and more alert plant men are turning to Rockbestos for sure performance under exacting conditions.

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NEW HAVEN 4, CONN.

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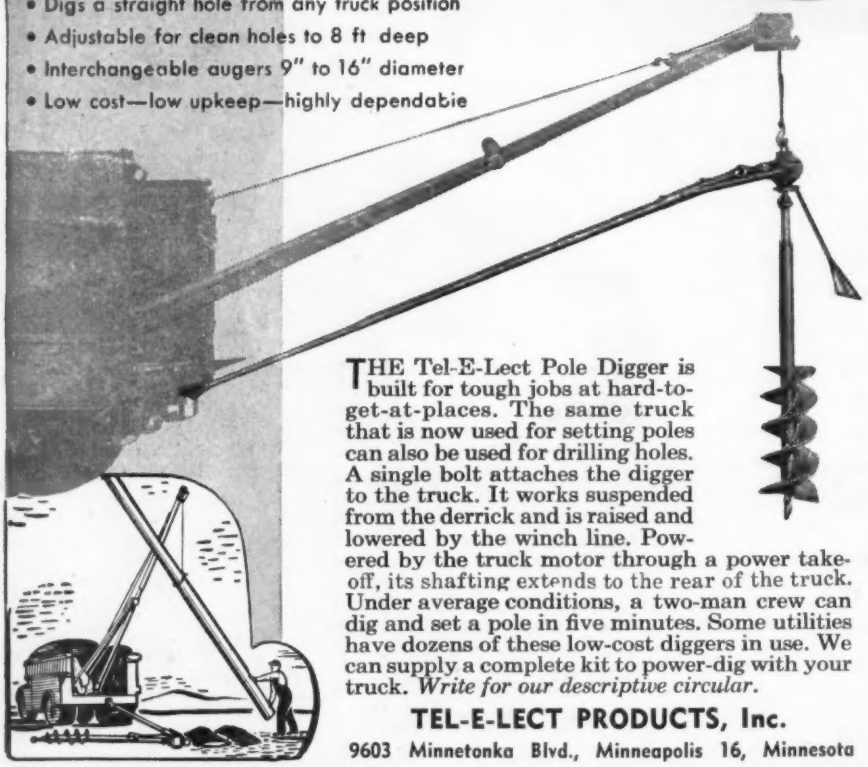
DIG HOLES WITH YOUR LINE TRUCK AND CREW

TEL-E-LECT POLE HOLE DIGGER

- Digs a straight hole from any truck position
- Adjustable for clean holes to 8 ft deep
- Interchangeable augers 9" to 16" diameter
- Low cost—low upkeep—highly dependable



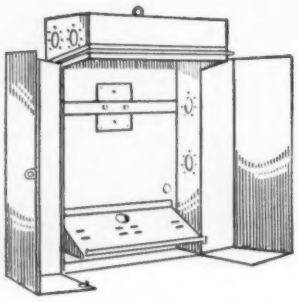
THE Tel-E-Lect Pole Digger is built for tough jobs at hard-to-get-at-places. The same truck that is now used for setting poles can also be used for drilling holes. A single bolt attaches the digger to the truck. It works suspended from the derrick and is raised and lowered by the winch line. Powered by the truck motor through a power take-off, its shafting extends to the rear of the truck. Under average conditions, a two-man crew can dig and set a pole in five minutes. Some utilities have dozens of these low-cost diggers in use. We can supply a complete kit to power-dig with your truck. *Write for our descriptive circular.*

TEL-E-LECT PRODUCTS, Inc.

9603 Minnetonka Blvd., Minneapolis 16, Minnesota

KEES TRANSFORMER HOUSING

For 4 Transformers . . .



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. . . 2 POTENTIAL

No. 3624-14

- Accommodates high insulation types of GE & Westinghouse transformers, ratio 20 to 1, 2300-volt primary.
- Mounting-bar which supports the two current transformers may be attached vertically or horizontally.
- 16-Gauge galvanized sheet steel, welded construction throughout. Doors hinged, both sides, with hold-backs and latch.
- The two potential transformers rest on shelf which slopes to front of housing—gives added clearance, makes installing and replacing easier.
- Knockouts for insulator bushings are spaced to coordinate with current transformers mounted either in vertical or horizontal position.

Manufacturers of Meter Boxes, Pull Fuse Switches, Meter Test Blocks, Portable Handi-Lites.

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F. D. KEES MFG. CO. BEATRICE NEBRASKA

RECENT RATE CHANGES

CONNECTICUT LIGHT & POWER Co has petitioned the State Utilities Commission for a $3,600,000 electric and gas rate increase. President R. H. Knowlton has stated that the company must have this additional revenue to carry out its $50,000,000 construction program in the next three years, in addition to $27,000,000 expended in the past three years. The program covers all kinds of equipment from generators to distribution facilities. The proposed rate increase averages about 10%. For customers using 40 kwhr per month the increase will run from a present charge of $2.18 to $2.36. The customer using 100 kwhr per month will pay $4.43, an increase of 45 cents. The company serves two-thirds of the Connecticut area.

SAVANNAH ELECTRIC & POWER Co has asked the Georgia Public Service Commission for authority to increase residential power rates in the Savannah area by 11.2%. The increase would bring the company an estimated additional $157,000 annually. The company requested that commercial rates be raised 10.7% for an additional $155,000 annually and a 24.6% increase in water heating rates for an additional $30,825. It was estimated the company would derive $33,000 additional annual revenue from customers now served under commercial rates schedule who would change to industrial rates in order to get a smaller increase.

CITIZENS UTILITIES Co, Nogales, Ariz., won a decision recently when the Arizona Corporation Commission denied the City of Nogales a rehearing on a recent 10% increase in electric rates granted the utility. In rejecting the city request, Wilson T. Wright, commission chairman, and William Brooks, member, declared, "no good cause or reason has been shown or exists for granting the rehearing."

NAPOLEON, OHIO, BOARD OF PUBLIC AFFAIRS increased electrical rates 10% on Nov 1 and water rates 10% on Jan 1, because operating expenses of the plant exceed income and no funds are left for improvements and repairs. After the increase becomes effective, the rates will be the same as they were in 1938. The new rate increase will bring in additional revenue of between $3,000 and $4,000 a month.

MENARD ELECTRIC COOPERATIVE, Petersburg, Ill., has announced a new schedule of electric rates which puts into effect a 28% increase for farm and home users of more than 400 kwhr bimonthly. Other brackets remain unchanged. The bimonthly rate under the new schedule will now be 1.6¢ per kwhr as compared to the previous figure of 1.25¢, which is equivalent to a 28% raise for the 200 kwhr bracket. The board of directors of the cooperative told its users that the new rate schedule resulted because of "mounting costs in the delivery" of electricity to its consumers and to maintain a sound financial condition. Another change by the board was to include the state 3% utility tax in the new rate schedule. Formerly the tax was added to the consumer's energy bill.

GEORGIA POWER Co's rate case, involving an approximate 10% increase in electric rates, has been reopened before the state Public Service Commission.

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THE PROPER MOOD

POWERSTAT Dimmers — dimming, brightening or blending light — can help create the proper mood. In stores, it makes merchandise more appealing, keeps personnel alert and cordial. In hotels, the air of luxurious living and fine service is enhanced by proper lighting treatment. In cocktail lounges and restaurants, changing light treatment adds profitable dollars to beverage and food checks — increases clientele and promotes repeat business.

The art of using light to create desired effects and moods stems from the theatre, where POWERSTAT Dimmers give smooth, precise control. In churches, the judicious use of light — controlled by POWERSTAT Dimmers — can intensify the atmosphere of dignity and reverence. And school auditoriums, gymnasiums and play stages, made more interesting through POWERSTAT Lighting Control, increase rental revenue and frequency with this modern economical equipment.

STORES

HOTELS

LOUNGES

THEATRES

RESTAURANTS

CHURCHES

SCHOOLS

by using POWERSTAT
LIGHT DIMMING EQUIPMENT

POWERSTAT Dimmers, versatile in application, *steplessly* dim any number of lamps up to rated load from complete black-out to full-on. They dim by transformer action without heat loss — handle incandescent or cold-cathode installations with equal economy, efficiency and precision.

Designed for manual or motor-driven operation, for direct or remote control, POWERSTAT Dimmers are available in numerous standard units to meet your specific requirements.

Write today for helpful, detailed information on POWERSTAT Light Dimming Equipment.

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Every instrument listed below was originally developed to meet someone's problem—to fill a need. We want to know about your instrument problem, no matter how impossible of solution it seems, or how trivial. Our research department is continually seeking for answers to the questions industry asks.

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- PHASE SEQUENCE INDICATOR: 2 models, 115, 230, 460 volts.
- SOIL RESISTIVITY METER: 0—30,000 ohms per cubic centimeter.

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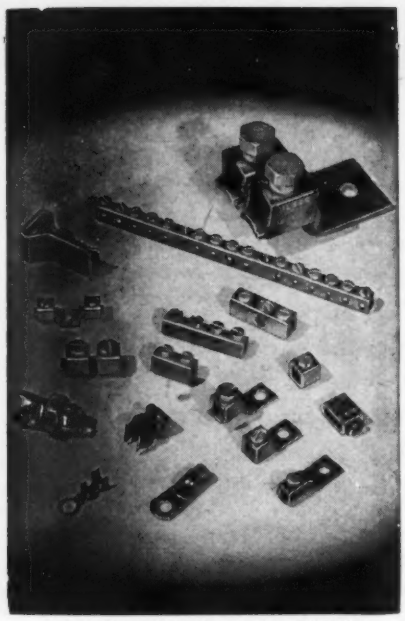

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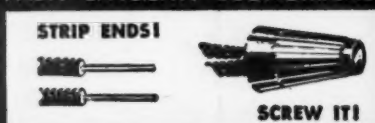

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NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included.

UTILITIES

Proposed Construction

Ia., Ames—U. S. Atomic Energy Comn., Iowa Area, Ames, plans by Tinsley, Higgins & Lighter, 526 Liberty Bldg., Des Moines, research bldg. at campus of Iowa State College, **$1,750,000.**

Kansas—Coffey Co. Rural Electric Co-operative Assn., Inc., J. Myers, mgr., Burlington, labor only 201.8 mi. rural distr. lines, 1-phase, 2-wire, Coffey Co., Proj. Kan. 26 H and K, Approx. $80,000. Flora Eng. Co., 821 E. 17 St., Cheyenne, Wyo., engr.

Md., Cumberland—Kelly Springfield, Tire Co., Cumberland, plans by Sergent & Lundy, 140 S. Dearborn St., Chicago, Ill., power plant imprvs. **$1,000,000.**

Missouri—Webster Electric Co-operative, Marshfield, 389.54 mi. rural distr. lines, Webster, Dallas, Christian and Greene Counties, $375,000. F. Horton & Co., Lamar, engrs.

Neb., Auburn — Bd. P. Wks., Frank Swain, mgr., Auburn, power plant alterations and addnl. power equip. $135,000. H. S. Nixon & Son, W. O. W. Bldg., Omaha, engrs.

New York — Bd. Transportation, 250 Hudson St., New York, Zone 13, furnishing, installing power equip. for Queens Line, Hillside Ave. exten. IND Div. (Equip. Contr. P-42), Queens Co.

North Dakota—Oliver-Mercer Electric Co-operative, Hazen, 688 mi. rural distr. lines, Oliver Co. **$1,055,000.**

Oklahoma—Kiamichi Electric Co-operative, Wilburton, 354 mi. rural distr. lines and completing previously approved constr., Latimer Co. **$765,000.**

Pa., West Mifflin—General Motors Corp., Fisher Body Div. General Motors Bldg., Detroit, Mich., stamping plant, main mfg. bldg., craneways, power plant, administration and offices, Canden Hall Rd. **$5,000,000.** Argonaut Realty Co., 310 Research Bldg., Detroit, Mich., engr.

Texas—Fannin County Electric Co-operative, Bonham, 225 mi. rural distr. lines, sys. imprvs. and 41 mi. tie lines, Fannin Co. **$560,000.**

Tex., Beaumont—Gulf States Utilities Co., 362 Liberty St., Neches Steam Power Station expan. **$4,000,000.**

Tex., Belton—Brazos River Transmission Electric Co-operative, Inc., 902 Amicable Bldg., Waco, power plant, incl. grading, roads; surface drainage; storm sewers; sanitary sewers, water lines; railroad switch tracks; elevated water steel storage tank and tower, near here. $650,000 available. Laramore & Douglas, Inc., 79 E. Adams St., Chicago 3, Ill., engr.

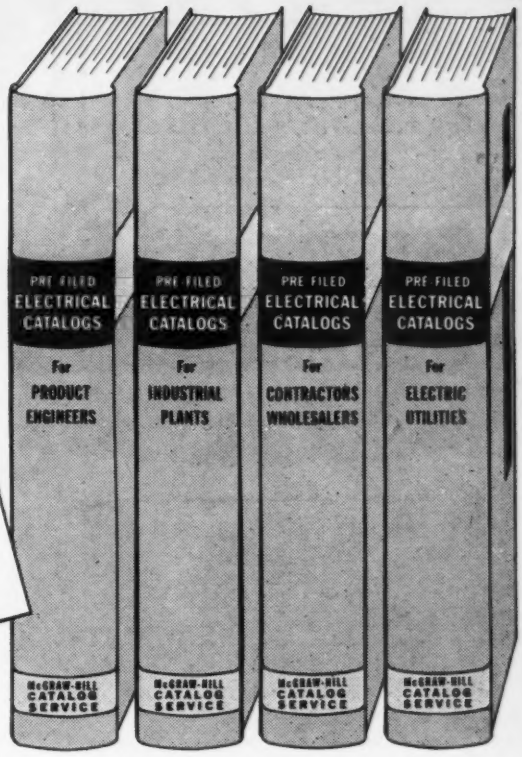
Tex., San Antonio—City Public Service Bd., 201 N. St. Marys St., reconstructing Comal-Grandview sub-station. **$200,000**; 2 new electric power sub-stations in outlying new dists., **$163,000.**

Tex., San Antonio—City P. Service Bd., 201 N. St. Marys St., expan. natural gas mains and laterals into outlying new dists. and existing old dists. new and pipe replacements, **$892,000**; constructing electrical transmission imprvs. mostly rehabilitation, replacements in various lines or sections of lines, **$349,000**; installing new 10 to 18 in. natural gas sys. feeder lines mostly into outlying new dists., **$377,200**; electric transmission lines through Comal-Grandview sub-station into new outlying dists., **$174,000**; street lighting area in new outlying dists., **$80,000**; electrical distr. lines, in outlying dists. **$1,608,000.**

Low Bidders & Contracts Awarded

Arizona-California-Nevada — Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., fabrication, installation one 82,500 kva. generator for Unit A4, Hoover Power

...who makes it?
...how is it made?
...how is it used?
...how is it ordered?



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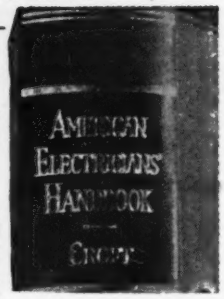

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1734 pages, 1327 illus, over 400 tables

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With this trouble-shooting book at your fingertips you'll see how quickly work problems can be simplified. In easy to understand language you are given the right facts in the way you want them . . . thoroughly indexed for quick finding. It covers everything from explanations and definitions of fundamentals to suggestions and ways for remedying the troubles of electrical equipment and maintaining high operating efficiency. It presents the kind of practical information that helps all practical electrical men — wiremen, contractors, linemen, plant superintendents, operators, construction engineers and others.

Bigger and Better New 6th Edition— In Accordance with 1947 National Electrical Code

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*SAVE: We pay mailing costs if you send cash with order. Same return privilege.

Plant, Boulder Canyon Proj., Spec. 2453, to Allis-Chalmers Mfg. Co., Continental Oil Bldg., Denver, Co., **$1,308,661.** Bids 10/26, awarded 11/2.

Illinois—Spoon River Electric Co-operative, Canton, Oct. 12, labor only 44 mi. 69 kv. transmission lines, three 69 kv. substations, Fulton Co., from A. A. Electric Co., Cicero, **$85,818.**

Ill., Chicago—St. Francis of Rome, Sisters of Charity of Incarnate, 1431 S. Austin St., Cicero, 2 and 3 story, brick, rein.-con., steel school and power plant, to Van Etten Bros., 11024 S. Michigan Ave. Est. **$700,000.**

Kentucky—U. S. Eng., 306 U. S. Court House, 7 Ave. and Broadway, Nashville, Tenn., furnishing, del. alternating current generators, 50,000 kva., Wolf Creek Power House, Cumberland River, near Jamestown, Inv. No. Eng. 40-058-49-9, to General Electric Co., 1 River Rd., Schenectady, N. Y., **$5,113,801.**

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., Oct. 28, two 37,500 kva. transformers and three 115,000 volt lightning arresters, Hungry Horse Proj., Spec. 2379, from Westinghouse Electric Corp., Gas & Electric Bldg., Denver, Colo., **$124,952.**

New York—Triborough Bridge & Tunnel Auth., 10 State St., New York, Zone 4, Nov. 4, electrical work for Brooklyn-Battery Tunnel, Contr. BBT-12 from Fischback & Moore, Inc., 226 E. 41 St., New York, Zone 17. **$1,292,000.**

Ore., The Dalles—Northern Wasco Utility Dist., The Dalles, Nov. 4, electric distr. facilities within The Dalles area, from Montgomery Electric Co., 1001 S. W. 5 St., Portland, **$80,396.**

South Dakota and Nebraska—Bureau Reclamation, Dpt. Interior, 504 Conroy Bldg., Casper, Wyo., constructing Fort Randall-O'Neill 115 kilovolt transmission line, Transmission Lines Unit, Missouri River Basin Proj., near Fort Randall, S. D. and O'Neill, Neb., Spec. 2466.

Wash., Odair — Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., one 12,500 kva. generator for station service unit L S-3, Columbia Basin Proj., Grand Coulee Power Plant, Spec. 2343, to Westinghouse Electric Corp., Gas and Electric Bldg., Denver, Colo., **$170,151.** Bids 9/23.

Wisconsin—Price Electric Co-operative, Phillips, 165 mi. rural distr. lines, Price Co., to Malone & Inman, Inc., Phillips, **$109,397.** Bids 10/26.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ill., Chicago—Suburban Cook Co. Tuberculosis. Sanitary Dist., 1126 N. East Ave., Oak Park, plans by Schmidt, Garden & Erickson, 104 S. Michigan Ave., 3 tuberculosis hospitals Cook Co. **$6,000,000** bonds voted.

Michigan—U. S. Eng., 609 Federal Bldg., Detroit, 10 story, rein.-con., brick, limestone 500 bed hospital, service bldg., etc. $10,000,000. Harley, Ellington & Day, 1507 Stroh Bldg., Zone 26, engrs. and archts.

O., Cincinnati—Bd. Educ., 216 E. 9 St., voted **$12,500,000** bonds, schools.

Pa., Ambridge—General Motors Corp., Fisher Body Div., General Motors Bldg., Detroit, Mich., blanking plant alterations, Old American Bridge Navy Plant, general alterations to convert war surplus plant for blanking steel for automobile bodies. **$2,000,000.**

Va., Virginia Beach—W. Taylor Johnson Assoc., 201 E. Plume St., Norfolk, plans by T. David Fitz-Gibbon, Royster Bldg., Norfolk, 16 story, 272 unit, concrete, steel, brick Mayflower Apartments. **$2,500,000.**

Low Bidders & Contracts Awarded

Pa., Cheltenham—Widener Park, Inc., c/o James G. Ludwick, archt., 6403 Market St., Upper Darby, apartment development, Washington Lane and Cheltenham Ave., separate contracts. **$16,000,000.**

Tex., Port Lavaca—Aluminum Co. of America, Point Comfort, via Port Lavaca P. O., (1st unit) aluminum mfg. plant, for 3 pot rooms or more of 4 structures each; administration bldg.; 3 masonry engine houses; cafeteria; store bldg.; incl. addnl. plant constr. to above, to Consolidated Western Constructors, Inc., 5201 Fannin St., Houston, Approx. **$9,500,000.** Est. $3,000,000.

CATALOGS • BULLETINS

● COMPOUNDS: Contained in a 24-page booklet are important physical characteristics of materials in eleven general categories, some being inpregnating and dipping waxes, cable saturating and finishing waxes, synthetic ceresines, potting compounds, rubber seals, also dry and storage battery seals. Mitchell-Rand Insulation Co, 51 Murray St, New York 7, N. Y.

● UNIT SUBSTATIONS: A 20-page planning and engineering guidebook, 11B6895, provides dimensional and arrangement information to enable industrial unit substation users to determine space requirements as soon as the unit is specified. Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

● CRANE: Hydro-lift truck crane convertible to shop crane with 45-in. boom; lifts 2,000 lb, 77-in. in 37 sec. Description, specifications and applications given in leaflet. Cardinal Corp, 1835 University Ave, St. Paul 4, Minn.

● TRANSFORMERS: Bulletin 1648 outlines a new base designed for single and 3-phase transformers, 167 kva and larger, and illustrates the ease of jacking, pulling and tipping the transformer. Pennsylvania Transformer Co, Box 6208, Pittsburgh 12, Pa.

● RECTIFIERS: An 8-page catalog describes, illustrates and gives engineering data on a line of selenium rectifiers (range 6 to 28 v, maximum 4000 amp in single cabinet) for electroplaters, electypers and anodizers. Richardson-Allen Corp, 15 West 20th St, New York, N. Y.

● LUMINAIRES: A 52-page catalog 48-N gives descriptions, specifications, engineering data and uses on the company's line of fluorescent luminaires, troffers, strips, and companion incandescent equipment. Pittsburgh Reflector Co, Oliver Bldg, Pittsburgh 22, Pa.

● POWER TUBES: An 8-page bulletin tabulates data on more than a score of power and transmitting tubes with rated plate dissipation ranging from 20 to 175 w. Sylvania Electric Products, Inc, Emporium, Pa.

● INDICATOR: For solder tin content indicator model 2870, bulletin D700-1 contains specifications, explanation of the method of determining tin content of a solder batch. Wheelco Instruments Co, Harrison St and Peoria St, Chicago 7, Ill.

● MOTORS: A 4-page bulletin PB-7000-2 describes the Fabri-steel, squirrel-cage induction motors built in sizes 150 to 1000 hp. Nineteen illustrations and one line drawing show construction details. Elliott Co, Technical Data Dept, Jeannette, Pa.

● WIRE AND CABLE: Handbook and Catalog 10-F gives engineering data, illustrates and describes wires, cables and flexible cords designed for use where conductors are exposed to heat, corrosive fumes, grease, oil or fire hazard. Rockbestos Products Corp, 285 Nicoll St, New Haven 4, Conn.